

With our global brands of Multilin, MDS, Lentrionics and ITI, GE Digital Energy™ designs, manufactures, distributes and supports a full range of protection, control, metering, telecommunications and power sensing equipment, software and services for industrial, utility and transportation customers.

The Multilin line of protection and control products are based on industry leading technologies essential for the reliable operation of mission-critical applications including generation, transmission, distribution, metering, motors, and communications. Multilin protection relays and systems are complemented with a complete line of substation hardened multiplexers, Ethernet switch network devices, and wireless radios for utility teleprotection, industrial, transit, railways, and highway traffic management systems. Every aspect of device configuration and monitoring is made simple through the powerful EnerVista™ suite of software tools. All relays are programmed and managed through EnerVista™ Software.

The GE Digital Energy™ ITI brand of power sensing products include a full line of current, voltage and potential transformers, switches, indicating lights and other protection relay accessories.

Complimenting our products, we also offer a complete range of consulting services, customized panel solutions and fully integrated energy management systems for effective energy savings.

For more information on these products, please visit our website at www.gedigitalenergy.com or contact your local sales representative. GE Digital Energy™ provides worldwide customer support 24/7 for its products and systems through its Customer Support Centers.

Contact us directly:

North America / Worldwide
215 Anderson Ave.
Markham, Ontario
Canada L6E 1B3
Toll Free (NA Only):
1-800-547-8629
Tel.: 905-294-6222
Fax: 905-201-2098
E-mail: gemultilin@ge.com

Europe / Middle East / Africa
Avenida Pinoa 10-48170
Zamudio (Vizcaya), Spain
Tel.: +34 94 485 88 00
Fax: +34 94 485 88 45
E-mail: gemultilin.euro@ge.com

Asia
Floor 22-24, No 900 Yishan Rd.
Scientific Building C
Shanghai, China 200233
Tel.: +86 21 2401 3208
Fax: +86 21 5423 5080

Protection & Control

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Relays and Meters Protection and Control Product Families

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[UR Universal Relay Family](#)

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Superior protection, control and communication for utility and industrial applications.

The Universal Relay (UR) is a family of leading edge protection and control products built on a common modular platform. All UR products feature high performance protection, expandable I/O options, integrated monitoring and metering, high speed communications, and extensive programming and configuration capabilities.



[SR Relay Family](#)

[page 22-13](#)

Competitive industrial power management systems for motors, generators, transformers and feeders.

The SR Family of protection relays represents a multi-functional line of products, with draw out capabilities. By providing protection, control, monitoring, metering, and both local and remote user interfaces in one assembly, the SR relays effectively eliminate the need for expensive discrete components.



[650 Relay Family](#)

[page 22-14](#)

Advanced protection, control and monitoring system.

The 650 family of relays incorporate a new generation of products that provides comprehensive protection, control monitoring and metering in a compact and cost effective package. The architecture is a complete solution for different applications, that complies with the most relevant international standards, including IEC61850 protocol.



[SR 3 Family](#)

[page 22-15](#)

Protective relay systems for feeders, motors and transformers

The SR 3 Series protection relays family is a highly functional and economical protection system. They provide a system for protection, control, monitoring and metering, and both local and remote user interfaces in one assembly.



[MII Modular Microprocessor Family](#)

[page 22-17](#)

An economical choice for digital relaying applications.

The MII Family offers a competitive solution that combines advanced protection, monitoring, widely accepted communications standards, and flexible configuration tools for a range of protection applications.



Relays and Meters Protection & Control

UR & UR^{Plus}

Proven, State-of-the-Art Protection & Control Systems

Section 22

Key Benefits

- Modular construction: common hardware, reduced stock of spare parts, plug & play modules for maintenance cost savings and simplification
- Proven flexibility and customization capabilities make UR/UR^{Plus} devices suitable to retrofit almost any kind of legacy P&C scheme
- Large HMI and annunciator panels provide local monitoring and control capabilities, and backup the substation HMI
- Phasor Measurement Unit (synchrophasor) according to IEEE® C37.118 (2011) and IEC® 61850-90-5 directly streamed from your protective device
- Three ethernet ports enable purpose specific LAN support that eliminates latency effect of heavy traffic protocols on mission critical communication services
- Embedded IEEE 1588 time synchronization protocol support eliminates dedicated IRIG-B wiring requirements for P&C devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, based, AAA, Radius, RBAC, Syslog)
- Enhanced CT/VT module diagnostics verify analog signal integrity using an advanced algorithm, ensuring reliability
- Reduces system event analysis effort with the support of embedded high-end and extended recording functionality

Applications

- Protection, control, monitoring and supervision of power assets across generation, transmission, distribution, substation and industrial systems
- Utility substation and industrial plant automation
- Digital fault recording and Sequence of Event (SOE) recording
- Predictive maintenance through data analysis and trending
- Synchrophasor based monitoring and control systems with specialized PMU devices that support multiple feeders
- Complex protection & control and wide area monitoring solutions with complete diagnostic and automation capabilities (UR^{Plus})



Features

Protection and Control

- Fast and segregated line current differential and distance protection functionality in a single device
- Phase segregated line current differential with adaptive restraint and ground differential, stub bus protection
- Phase distance (five zones) with independent settings for compensation
- Single-pole tripping, breaker-and-half with independent current source support
- Complete generator protection with 100% stator ground fault detection with sub-harmonic injection and field ground protection



Relays and Meters Protection & Control UR & UR^{Plus}

Proven, State-of-the-Art Protection & Control Systems

Features (Continued)

Communications

- Networking interfaces: 10 or 100MB copper or fiber optic Ethernet, RS485, RS232, RS422, G.703, C37.94, up to three independent ethernet ports
- Multiple protocols: IEC 61850, DNP 3.0 Level 2, Modbus® RTU, Modbus TCP/IP, IEC 60870-5-104, Ethernet Global data, IEEE 1588 and PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip and I/O extension applications

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Synchrophasors in select products with IEEE C37.118 (2011) and IEC 61850-90-5 support
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Fault locator and user-programmable fault reports
- Breaker condition monitoring including breaker arcing current (I_{2t}), breaker re-strike and breaker flashover
- Metering: current, voltage, power, power factor, frequency, voltage & current harmonics, energy, demand, phasors, etc.

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify configuration and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the UR Family into new or existing monitoring and control systems



Features	ANSI	B30	B90	B95 ^{Plus}	C30	C60	C70	C90 ^{Plus}	D30
Protection									
1. Disturbance Detector							•	•	•
2. Mho Distance, Phase (No. of Zones)	21P								5
3. Mho Distance, Ground or Neutral Phase (No. of Zones)	21G/N								3
4. Quadilateral Distance, Phase (No. of Zones)	21P								3
5. Quadilateral Distance, Ground or Neutral (No. of Zones)	21G/N								3
6. Permissive Pilot Logic									
7. Sub-Cycle Distance									
8. Overexcitation Protection (V/Hz)	24								
9. Synchronism Check or Synchronizing	25					•		•	•
10. Undervoltage, Phase	27P	•	•	•		•	•	•	•
11. Undervoltage, Auxiliary	27X					•		•	•
12. Stator Ground (3rd Harmonic)	27TN								
13. Sensitive Directional Power	32S					•		•	
14. Loss of Excitation – Based on Reactive Power	40Q								
15. Loss of Excitation – Based on Impedance Element	40								
16. Current Unbalance	46								
17. Broken Conductor Detection	46BC								
18. IOC, Negative Sequence	46/50						•	•	•
19. TOC, Negative Sequence	46/51						•	•	•
20. Current Directional, Negative Sequence	46/67							•	•
21. Reverse Phase Sequence Voltage	47							•	
22. Thermal Model	49								
23. Inadvertent/Accidental Energization	50/27								
24. End of Fault Protection			•	•					
25. Motor Mechanical Jam									
26. Motor Start Supervision									
27. Motor Acceleration Time									
28. User Programmable Curves		•				•	•	•	•
29. Breaker Failure	50BF	•	•	•		•	•	•	Logic
30. IOC, Phase	50P	•	•	•		•	•	•	•
31. IOC, Ground	50G	•				•	•	•	•
32. IOC, Neutral	50N	•				•	•	•	•
33. IOC, Sensitive Ground	50SG	•				•			•
34. High Impedance Fault Detection									
35. TOC, Phase	51P	•	•	•		•	•	•	•
36. TOC, Ground	51G	•				•	•	•	•
37. TOC, Neutral	51N	•				•	•	•	•
38. TOC, Sensitive Ground	51SG	•				•			•
39. TOC, Voltage Restrained	51V	•				•	•	•	•
40. Overvoltage, Phase	59P						•	•	•
41. Overvoltage, Auxiliary	59A	•				•	•	•	•
42. Overvoltage, Neutral	59N	•				•	•	•	•
43. Negative Sequence Overvoltage	59-2						•	•	•
44. 100% Stator Ground Protection	64TN							•	•
45. Current Directional, Phase	67P							•	•
46. Current Directional, Neutral	67N							•	•
47. Current Directional, Negative Sequence	46/67							•	•
48. Power Swing Blocking	68								•
49. Out-of-Step Tripping	78								•
50. AC Reclosing (No. of Shots)	79					4		•	4
51. Switch on to Fault (Line Pickup)	SOTF								•
52. Voltage Transformer Fuse Failure	VTFF					•	•	•	•
53. Current Transformer Supervision	50/74	•	•	•					•
54. Load Encroachment Logic									•
55. Underfrequency	81U							•	
56. Overfrequency	81O							•	
57. Anti-Islanding Protection/Frequency Rate of Change	81R							•	
58. Lockout Functionality	86	•	•	•	•	•	•	•	•
59. Bus Differential	87B	•	•	•					
60. Line Current Differential	87L								
61. Ground Differential	87G								
62. Stator Differential	87S								
63. Group Differential	87T								
64. Line Phase Comparison	87PC								
65. Voltage Differential							•		
66. Capacitor Bank Overvoltage							•		
67. Neutral Voltage Unbalance							•		
68. Automatic Voltage Regulation							•		
69. Time of Day Control							•		
70. Instantaneous Differential	50/87	•	•	•					
71. Split Phase Protection									
72. Line Current Differential Trip Logic									
73. CT Failure									



Selector Guide

Section 22

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UR Technical Specifications

PROTECTION	
100% STATOR GROUND	
Operating quantity:	V _{neutral_3rd} /V _{neutral_3rd} + V _{zero_3rd}
Pickup level:	0.000 to 0.250 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±2% of reading from 1 to 120 V
Pickup delay:	0 to 600.00 s in steps of 0.01
3rd harmonic supervision level:	0.0010 to 0.1000 pu in steps of 0.0001
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 × Pickup at 60 Hz

ACCELERATION TIME	
Acceleration current:	1.00 to 10.00 × FLA in steps of 0.01
Acceleration time:	0.00 to 180.00 s in steps of 0.01
Operating mode:	Definite Time, Adaptive

ACCIDENTAL ENERGIZATION	
Operating condition:	Overcurrent
Arming condition:	Undervoltage and/or Machine Offline
Overcurrent:	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading from 0.1 to 2.0 × CT rating

Undervoltage:	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Level accuracy:	±0.5% of reading 10 to 208 V
Operate Time:	< 30 ms at 1.10 × Pickup at 60 Hz

AUTORECLOSURE C60/D60/L90/L60	
Two breakers applications	
Single- and three-pole tripping schemes	
Up to 4 reclose attempts before lockout	
Selectable reclosing mode and breaker sequence	

AUTORECLOSURE F60/F35/D30	
Single breaker applications, 3-pole tripping schemes	
Up to 4 reclose attempts before lockout	
Independent dead time setting before each shot	
Possibility of changing protection settings after each shot with FlexLogic.	

AMP UNBALANCE	
Avg and Full Load amps:	RMS
L1 and L2 amps:	Phasor
Pickup level:	0.0 to 100.0% in steps of 0.1
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.1
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operate time:	< 20 ms at 1.10 × pickup at 60 Hz
Timing accuracy:	±3% or ±20 ms, whichever is greater

AUXILIARY OVERVOLTAGE	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Pickup delay:	0 to 600.00 s in steps of 0.01
Reset delay:	0 to 600.00 s in steps of 0.01
Timing accuracy:	±3% of operate time or ±4 ms (whichever is greater)
Operate time:	< 30 ms at 1.10 × pickup at 60 Hz

AUXILIARY UNDERVOLTAGE	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Level accuracy:	±0.5% of reading from 10 to 208 V
Curve shapes:	GE IAV/Inverse, Definite Time
Curve multiplier:	Time Dial = 0 to 600.00 in steps of 0.01
Timing accuracy:	±3% of operate time or ±4 ms (whichever is greater)

BREAKER ARCING CURRENT	
Principle:	Accumulates breaker duty (I ² t) and measures fault duration
Initiation:	Programmable per phase from any FlexLogic operand
Compensation for auxiliary relays:	0 to 65.535 s in steps of 0.001
Alarm threshold:	0 to 50000 kA ² -cycle in steps of 1
Fault duration accuracy:	0.25 of a power cycle
Availability:	1 per CT bank with a minimum of 2

PROTECTION	
BREAKER FAILURE	
Mode:	1-pole, 3-pole
Current supervision:	phase, neutral current
Current supv. pickup:	0.001 to 30.000 pu in steps of 0.001
Current supv. dropout:	97 to 98% of pickup
Current supv. accuracy:	0.1 to 2.0 × CT rating: ±0.75% of reading or ±2% of rated (whichever is greater)
above 2 × CT rating:	±2.5% of reading

BREAKER FLASHOVER	
Operating quantity:	Phase current, voltage and voltage difference
Pickup level voltage:	0 to 1.500 pu in steps of 0.001
Dropout level voltage:	97 to 98% of pickup
Pickup level current:	0 to 1.500 pu in steps of 0.001
Dropout level current:	97 to 98% of pickup
Level accuracy:	±0.5% or ±0.1% of rated, whichever is greater
Pickup delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±42 ms, whichever is greater
Operate time:	<42 ms at 1.10 × pickup at 60 Hz

BUS DIFFERENTIAL (87B)	
Pickup level:	0.050 to 6.000 pu in steps of 0.001
Low slope:	15 to 100% in steps of 1
High slope:	50 to 100% in steps of 1
Low breakpoint:	1.00 to 30.00 pu in steps of 0.01
High breakpoint:	1.00 to 30.00 pu in steps of 0.01
High set level:	0.10 to 99.99 pu in steps of 0.01
Dropout level:	97 to 98% of Pickup
Level accuracy:	
0.1 to 2.0 × CT rating:	±0.5% of reading or ±1% of rated (whichever is greater)
>2.0 × CT rating:	±1.5% of reading
Operating time:	one power system cycle (typical)

CT TROUBLE	
Responding to:	Differential current
Pickup level:	0.020 to 2.000 pu in steps of 0.001
Pickup delay:	1.0 to 60.0 sec. in steps of 0.1
Time Accuracy:	±3% or ±40ms, whichever is greater
Availability:	1 per zone of protection (890)

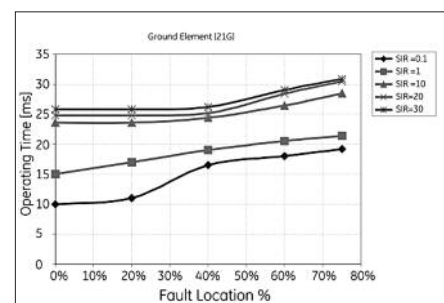
GENERATOR UNBALANCE	
Gen. nominal current:	0.000 to 1.250 pu in steps of 0.001
Stages:	2 (I ² t with linear reset and definite time)
Pickup level:	0.00 to 100.00% in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	
0.1 to 2 × CT rating:	±0.5% of reading or 1% of rated (whichever is greater)
> 2.0 × CT rating:	±1.5% of reading
Time dial (K-value):	0.00 to 100.00 in steps of 0.01
Pickup delay:	0.0 to 1000.0 s in steps of 0.1
Reset delay:	0.0 to 1000.0 s in steps of 0.1
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 50 ms at 60 Hz

GROUND DISTANCE	
Characteristic:	Mho (Memory polarized or offset) or Quad (Memory polarized or non-directional), selectable individually per zone
Reactance polarization:	negative-sequence or zero-sequence current
Non-homogeneity angle:	-40 to 40° in steps of 1
Number of zones:	5
Directionality:	Forward, Reverse, or Non-Directional per zone
Reach (secondary W):	0.02 to 250.00 in steps of 0.01
Reach accuracy:	±5% including the effect of CVT transients up to an SIR of 30

Distance characteristic angle:	30 to 90° in steps of 1
Distance comparator limit angle:	30 to 90° in steps of 1
Directional supervision	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Zero-sequence compensation	
Z0/Z1 magnitude:	0.00 to 10.00 in steps of 0.01
Z0/Z1 angle:	-90 to 90° in steps of 1
Zero-sequence mutual compensation	
Z0M/Z1 magnitude:	0.00 to 7.00 in steps of 0.01
Z0M/Z1 angle:	-90 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001

PROTECTION	
Timing accuracy:	±3% or 4 ms, whichever is greater
Current supervision:	
Level:	neutral current (3I ₀)
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%
Memory duration:	5 to 25 cycles in steps of 1
Voltage supervision pickup	0 to 5.000 pu in steps of 0.001
(series compensation applications):	
Operation time:	1 to 1.5 cycles (typical)
Reset time:	1 power cycle (typical)

GROUND DISTANCE OPERATING TIME CURVES	
The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).	



LINE CURRENT DIFFERENTIAL (87L)	
Application:	2 or 3 terminal line, series compensated line, tapped line, with charging current compensation
Pickup current level:	0.20 to 4.00 pu in steps of 0.01
CT Tap	0.20 to 5.00 in steps of 0.01
(CT mismatch factor):	
Slope # 1:	1 to 50%
Slope # 2:	1 to 70%
Breakpoint between slopes:	0.0 to 20.0 pu in steps of 0.1
DTT:	Direct Transfer Trip (1 and 3 pole) remote L90
Operating Time:	1.0 to 1.5 power cycles duration
Asymmetrical channel delay compensation using GPS:	asymmetry up to 10ms

LINE CURRENT DIFFERENTIAL TRIP LOGIC	
87L trip:	Adds security for trip decision; creates 1 and 3 pole trip logic
DTT:	Engaged Direct Transfer Trip (1 and 3 pole) from remote L90
DD:	Sensitive Disturbance Detector to detect fault occurrence
Stub bus protection:	Security for ring bus and 1½ breaker configurations
Open pole detector:	Security for sequential and evolving faults

LINE PICKUP	
Phase IOC:	0.000 to 30.000 pu
Undervoltage pickup:	0.000 to 3.000 pu
Overvoltage delay:	0.000 to 65.535 s

LOAD ENCRoACHMENT	
Responds to:	Positive-sequence quantities
Minimum voltage:	0.000 to 3.000 pu in steps of 0.001
Reach (sec. W):	0.02 to 250.00 in steps of 0.01
Impedance accuracy:	±5%
Angle:	5 to 50° in steps of 1
Angle accuracy:	±2°
Pickup delay:	0 to 65.535 s in steps of 0.001
Reset delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±4 ms, whichever is greater
Operate time:	< 30 ms at 60 Hz

LOSS OF EXCITATION	
Operating condition:	Positive-sequence impedance
Characteristic:	2 independent offset mho circles
Center:	0.10 to 300.0 (sec.) in steps of 0.01
Radius:	0.10 to 300.0 (sec.) in steps of 0.01
Reach accuracy:	±3%
Undervoltage supervision	
Level:	0.000 to 1.250 pu in steps of 0.001
Accuracy:	± 0.5% of reading from 10 to 208V
Pickup delay:	0 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	<50 ms



Relays and Meters Protection & Control UR & UR^{Plus}

Section 22

UR Technical Specifications, continued

PROTECTION

MECHANICAL JAM

Operating condition:	Phase overcurrent
Arming condition:	Motor not starting
Pickup level:	1.00 to 10.00 x FLA in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	at 0.1 to 2.0 x CT: $\pm 0.5\%$ of reading
at $> 2.0 \times$ CT rating:	$\pm 1.5\%$ of reading
Pickup delay:	0.10 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Time accuracy:	$\pm 3\%$ or ± 20 ms, whichever is greater

MOTOR START SUPERVISION

Maximum no. of starts:	1 to 16 in steps of 1
Monitored time interval:	1 to 300 minutes in steps of 1
Time between starts:	0 to 300 minutes in steps of 1
Restart delay:	0 to 5000 seconds in steps of 1

NEGATIVE SEQUENCE DIRECTIONAL OC

Directionality:	Co-existing forward and reverse
Polarizing:	Voltage
Polarizing voltage:	V ₂
Operating current:	I ₂ or I ₀
Level sensing:	
Zero-sequence:	$ I_0 - K \times I_1 $
Negative-sequence:	$ I_2 - K \times I_1 $
Restraint, K:	0.00 to 0.500 in steps of 0.001
Characteristic angle:	0 to 90° in steps of 1
Limit angle:	40 to 90° in steps of 1, independent for forward and reverse
Angle accuracy:	$\pm 2^\circ$
Offset impedance:	0.00 to 250.00W in steps of 0.01
Pickup level:	0.05 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98%
Operation time:	< 16 ms at 3 x Pickup at 60 Hz

NEGATIVE SEQUENCE IOC

Current:	Phasor
Pickup level:	0.000 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	
0.1 to 2.0 x CT rating:	$\pm 0.5\%$ of reading or $\pm 1\%$ of rated (whichever is greater) $> 2.0 \times$ CT rating: $\pm 1.5\%$ of reading
Overreach:	< 2%
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operation time:	< 20 ms at 3 x Pickup at 60 Hz
Timing accuracy:	Operate at 1.5 x Pickup $\pm 3\%$ or ± 4 ms (whichever is greater)

NEGATIVE SEQUENCE OVERVOLTAGE

Pickup level:	0.000 to 1.250 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	$\pm 0.5\%$ of reading from 10 to 208 V
Pickup delay:	0 to 600.00 s in steps of 0.01
Reset delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	$\pm 3\%$ or ± 20 ms, whichever is greater
Operation time:	< 30 ms at 1.10 x Pickup at 60 Hz

NEGATIVE SEQUENCE TOC

Current:	Phasor
Pickup level:	0.000 to 30.000 pu in steps of 0.001
Dropout level:	97% to 98% of Pickup
Level accuracy:	$\pm 0.5\%$ of reading or $\pm 1\%$ of rated (whichever is greater) from 0.1 to 2.0 x CT rating $\pm 1.5\%$ of reading $> 2.0 \times$ CT rating
Curve shapes:	IEEE Moderately/Very/Extremely Inverse; IEC (and BS) A/B/C and Short Inverse; GE IAC Inverse, Short/Very/Extremely Inverse; I2t; FlexCurves. (programmable); Definite Time (0.01 s base curve)
Curve multiplier (Time dial):	0.00 to 600.00 in steps of 0.01
Reset type:	Instantaneous/Timed (per IEEE) and L ear
Timing accuracy:	Operate at $> 1.03 \times$ Actual Pickup $\pm 3.5\%$ of operate time or $\pm 1/2$ cycle (whichever is greater)
Operate time:	< 30 ms at 1.10 x Pickup at 60 Hz

NEUTRAL DIRECTIONAL OVERCURRENT

Directionality:	Co-existing forward and reverse
Polarizing:	Voltage, Current, Dual
Polarizing voltage:	V ₀ or V _X
Polarizing current:	I _G
Operating current:	I ₀
Level sensing:	$3 \times (I_0 - K \times I_1)$, I _G
Restraint, K:	0.000 to 0.500 in steps of 0.001
Characteristic angle:	-90 to 90° in steps of 1
Limit angle:	40 to 90° in steps of 1, independent for forward and reverse
Angle accuracy:	$\pm 2^\circ$
Offset impedance:	0.00 to 250.00W in steps of 0.01
Pickup level:	0.05 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98%
Operation time:	< 16 ms at 3 x Pickup at 60 Hz

NEUTRAL OVERVOLTAGE

Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	$\pm 0.5\%$ of reading from 10 to 208 V
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Timing accuracy:	$\pm 3\%$ or ± 20 ms (whichever is greater)
Operation time:	< 30 ms at 1.10 x Pickup at 60 Hz

PROTECTION

OPEN POLE DETECTOR

Detects an open pole condition, monitoring breaker auxiliary contacts, the current in each phase and optional voltages on the line	
Current pickup level:	0.000 to 30.000 pu in steps of 0.001
Line capacitive reactances (XC1, XC0):	300.0 to 9999.9 sec. W in steps of 0.1
Remote current pickup level:	0.000 to 30.000 pu in steps of 0.001
Current dropout level:	Pickup + 3%, not less than 0.05 pu

OVERFREQUENCY

Pickup level:	20.00 to 65.00 Hz in steps of 0.01
Dropout level:	Pickup - 0.03 Hz
Level accuracy:	± 0.01 Hz
Time delay:	0 to 65.535 s in steps of 0.001
Timer accuracy:	$\pm 3\%$ or 4 ms, whichever is greater

PHASE COMPARISON PROTECTION (87CP)

Signal Selection:	Mixed I ₂ - K x I ₁ (K=0.00 to 0.25 in steps of 0.01, 0.31, 0)
Angle Reference:	0 to 360° leading in steps of 1
Fault detector low:	
Instantaneous Overcurrent:	0.02 to 15.00 pu in steps of 0.01
I ₂ x Z - V ₂ :	0.005 to 15.00 pu in steps of 0.01
dI ₂ / dI ₁ :	0.01 to 5.00 pu in steps of 0.01
dI ₁ / dI ₂ :	0.01 to 5.00 pu in steps of 0.01
Fault detector High:	
Instantaneous Overcurrent:	0.10 to 15.00 pu in steps of 0.01
I ₂ x Z - V ₂ :	0.005 to 15.00 pu in steps of 0.01
dI ₂ / dI ₁ :	0.01 to 5.00 pu in steps of 0.01
dI ₁ / dI ₂ :	0.01 to 5.00 pu in steps of 0.01
Signal Symmetry Adjustment:	-0.5 to 5.0 ms in steps of 0.1

Channel Delay Adjustment:	0.000 to 30.00 ms in steps of 0.001
Channel Adjustments:	channel delay and signal symmetry compensation
Operate Time (Typical):	3/4 cycle for single phase comparison
Trip Security:	First coincidence or enhanced
Second Coincidence Timer:	10 to 200 ms in steps of 1
Enhanced Stability Angle:	40 to 180° in steps of 1

PHASE DIRECTIONAL OVERCURRENT

Relay connection:	90° (quadrature)
Quadrature voltage:	
ABC phase seq.:	phase A (V _{BC}), phase B (V _{CA}), phase C (V _{AB})
ACB phase seq.:	phase A (V _{CB}), phase B (V _{AC}), phase C (V _{BA})
Polarizing voltage threshold:	0.000 to 3.000 pu in steps of 0.001
Current sensitivity threshold:	0.05 pu
Characteristic angle:	0 to 359° in steps of 1
Angle accuracy:	$\pm 2^\circ$
Operation time (FlexLogic elements):	
Tripping (reverse load, forward fault):	< 12 ms, typically
Blocking (forward load, reverse fault):	< 8 ms, typically

PHASE DISTANCE

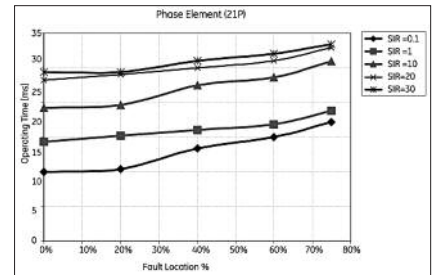
Characteristic:	Mho (memory polarized or offset) or Quad (memory polarized or non-directional), selectable individually per zone
Number of zones:	Up to 5
Directionality:	Forward, Reverse, or Non-Directional per zone
Reach (secondary W):	0.02 to 250.00 in steps of 0.01
Reach accuracy:	$\pm 5\%$ including the effect of CVT transients up to an SIR of 30
Distance:	
Characteristic angle:	30 to 90° in steps of 1
Comparator limit angle:	30 to 359° in steps of 1
Directional supervision:	
Characteristic angle:	30 to 90° in steps of 1
Limit angle:	30 to 90° in steps of 1
Right blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Left blinder (Quad only):	
Reach:	0.02 to 500 in steps of 0.01
Characteristic angle:	60 to 90° in steps of 1
Time delay:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	$\pm 3\%$ or 4 ms, whichever is greater
Current supervision:	
Level:	line-to-line current
Pickup:	0.050 to 30.000 pu in steps of 0.001
Dropout:	97 to 98%

PROTECTION

Memory duration:	5 to 25 cycles in steps of 1
VT location:	all delta-wye and wye-delta transformers
CT location:	all delta-wye and wye-delta transformers
Voltage supervision pickup (series compensation applications):	0 to 5.000 pu in steps of 0.001

PHASE DISTANCE OPERATING TIME CURVES

The operating times are response times of a microprocessor part of the relay. See output contacts specifications for estimation of the total response time for a particular application. The operating times are average times including variables such as fault inception angle or type of a voltage source (magnetic VTs and CVTs).



PHASE/NEUTRAL/GROUND IOC

Pickup level:	0.000 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	
0.1 to 2.0 x CT rating:	$\pm 0.5\%$ of reading or $\pm 1\%$ of rated (whichever is greater)
$> 2.0 \times$ CT rating:	$\pm 1.5\%$ of reading
Overreach:	< 2%
Pickup delay:	0.00 to 600.00 s in steps of 0.01
Reset delay:	0.00 to 600.00 s in steps of 0.01
Operation time:	< 16 ms at 3 x pickup at 60 Hz (Phase/Ground IOC) < 20 ms at 3 x pickup at 60 Hz (Neutral IOC)
Timing accuracy:	Operate at 1.5 x Pickup $\pm 3\%$ or ± 4 ms (whichever is greater)

PHASE/NEUTRAL/GROUND TOC

Current:	Phasor or RMS
Pickup level:	0.000 to 30.000 pu in steps of 0.001
Dropout level:	97% to 98% of Pickup
Level accuracy:	for 0.1 to 2.0 x CT: $\pm 0.5\%$ of reading or $\pm 1\%$ of rated (whichever is greater) for $> 2.0 \times$ CT: $\pm 1.5\%$ of reading $> 2.0 \times$ CT rating
Curve shapes:	IEEE Moderately/Very/Extremely Inverse; IEC (and BS) A/B/C and Short Inverse; GE IAC Inverse, Short/Very/Extremely Inverse; I2t; FlexCurves. (programmable); Definite Time (0.01 s base curve)
Curve multiplier:	Time Dial = 0.00 to 600.00 in steps of 0.01
Reset type:	Instantaneous/Timed (per IEEE)
Timing accuracy:	Operate at $> 1.03 \times$ actual Pickup $\pm 3.5\%$ of operate time or $\pm 1/2$ cycle (whichever is greater)

PHASE OVERVOLTAGE

Voltage:	Phasor only
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Level accuracy:	$\pm 0.5\%$ of reading from 10 to 208V
Pickup delay:	0.00 to 600.00 s in steps of 0.01 s
Operation time:	< 30 ms at 1.10 x Pickup at 60 Hz
Timing accuracy:	$\pm 3\%$ or ± 4 ms (whichever is greater)

PHASE UNDERVOLTAGE

Voltage:	Phasor only
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of Pickup
Level accuracy:	$\pm 0.5\%$ of reading from 10 to 208V
Curve shapes:	GE IAV Inverse; Definite Time (0.1 s base curve)
Curve multiplier:	Time Dial = 0.00 to 600.00 in steps of 0.01
Timing accuracy:	Operate at $< 0.90 \times$ Pickup $\pm 3.5\%$ of operate time or ± 4 ms (whichever is greater)

PILOT-AIDED SCHEMES

Direct Underreaching Transfer Trip (DUTT)
Permissive Underreaching Transfer Trip (PUTT)
Permissive Overreaching Transfer Trip (POTT)
Hybrid POTT Scheme
Directional Comparison Blocking Scheme



UR Technical Specifications, continued

PROTECTION	
POWER SWING DETECT	
Functions:	Power swing block, Out-of-step trip
Characteristic:	Mho or Quad
Measured impedance:	Positive-sequence
Blocking/tripping mozes:	2-step or 3-step
Tripping mode:	Early or Delayed
Current supervision:	
Pickup level:	0.050 to 30.000 pu in steps of 0.001
Dropout level:	97 to 98% of Pickup
Fwd / reverse reach (sec. W):	0.10 to 500.00W in steps of 0.01
Left and right blinders (sec. W):	0.10 to 500.00W in steps of 0.01
Impedance accuracy:	±5%
Fwd / reverse angle impedances:	40 to 90° in steps of 1
Angle accuracy:	±2°
Characteristic limit angles:	40 to 140° in steps of 1
Timers:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater
RATE OF CHANGE OF FREQUENCY	
df/dt trend:	increasing, decreasing, bi-directional
df/dt pickup level:	0.10 to 15.00 Hz/s in steps of 0.01
df/dt dropout level:	96% of pickup
df/dt level accuracy:	80 mHz/s or 3.5%, whichever is greater
Overvoltage supv.:	0.100 to 3.000 pu in steps of 0.001
Overcurrent supv.:	0.000 to 30.000 pu in steps of 0.001
Pickup delay:	0 to 65.535 s in steps of 0.001
Reset delay:	0 to 65.535 s in steps of 0.001
Time accuracy:	±3% or ±4 ms, whichever is greater
95% settling time for df/dt:	< 24 cycles
Operate time:	
at 2 x pickup:	12 cycles
at 3 x pickup:	8 cycles
at 5 x pickup:	6 cycles
RESTRICTED GROUND FAULT	
Pickup:	0.000 to 30.000 pu in steps of 0.001
Dropout:	97 to 98% of Pickup
Slope:	0 to 100% in steps of 1%
Pickup delay:	0 to 600.00 s in steps of 0.01
Dropout delay:	0 to 600.00 s in steps of 0.01
Operate time:	< 1power system cycle
SENSITIVE DIRECTIONAL POWER	
Measured power:	3-phase, true RMS
Number of stages:	2
Characteristic angle:	0 to 359° in steps of 1
Calibration angle:	0.00 to 0.95° in steps of 0.05
Minimum power:	-1.200 to 1.200 pu in steps of 0.001
Pickup level accuracy:	±1% or ±0.001 pu, whichever is greater
Hysteresis:	2% or 0.001 pu, whichever is greater
Pickup delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±4 ms, whichever is greater
Operate time:	50 ms
SPLIT PHASE PROTECTION	
Operating quantity:	split phast CT current biased by generator load current
Pickup level:	0.000 to 1.500 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated
Pickup delay:	0.000 to 65.535 s in steps of 0.001
Time accuracy:	±3% of ± cycles, whichever is greater
Operate time:	< 5 cycles at 1.10 x pickup at 60Hz
STATOR DIFFERENTIAL	
Pickup:	0.050 to 1.00 pu in steps of 0.01
Slope 1/2:	1 to 100% in steps of 1
Break 1:	1.00 to 1.50 pu in steps of 0.01
Break 2:	1.50 to 30.00 pu in steps of 0.01
Level accuracy:	±2%
SYNCHROCHECK	
Max voltage difference:	0 to 400000 V in steps of 1
Max angle difference:	0 to 100° in steps of 1
Max freq. difference:	0.00 to 2.00 Hz in steps of 0.01
Hysteresis for max. freq. diff.:	0.00 to 0.10 Hz in steps of 0.01
Dead source function:	None, LV1 & DV2; DV1 & LV2; DV1 or DV2; DV1 xor DV2; DV1 & DV2 (L = Live, D = Dead)

PROTECTION	
THERMAL MODEL	
Thermal overload curves:	Standard curve, FlexCurve, voltage dependent curve
Standard Curve:	0.00 to 600.00 in steps of 0.01
Time Multiplier:	
Thermal Overload Pickup:	pu = overload factor x FLA
Overload IOP:	1.00 to 1.50 in steps of 0.001
Standard Overload Curve:	
trip time =	$TD \times 2.2116623 \times \frac{0.02530337 \times \left(\frac{I_{motor}}{OF \times FLA} \right)^2 + 0.05054758 \times \frac{I_{motor}}{OF \times FLA}}{1}$
Motor Rated Voltage:	1 to 50000 V in steps of 1
Thermal Motor Biasing:	Current unbalance, RTDs
Thermal Model:	1 power cycle
Update Rate:	
Stopped/Running Time:	1 to 65000 min. in steps of 1
Cool Constants:	
Stopped/Running Time:	Exponential
Cool Constants Decay:	
Hot/Cold Safe Stall Ratio:	0.01 to 1.00 in steps of 0.01
Current Accuracy:	Per phase current inputs
Current Source:	True RMS
Timing Accuracy:	± 100 ms or ± 2% whichever is greater
Timing Accuracy:	± 100 ms or ± 4%, whichever is greater for Voltage
Dependent Overload:	
THIRD HARMONIC NEUTRAL UNDERVOLTAGE	
Operating quantity:	3rd harmonic of auxiliary undervoltage
Undervoltage:	
Pickup level:	0.000 to 3.000 pu in steps of 0.001
Dropout level:	102 to 103% of pickup
Accuracy:	±2% of reading from 1 to 120V
Power:	
Pickup level:	0.000 to 1.200 pu in steps of 0.001
Dropout level:	97 to 98% of pickup
Accuracy:	±5% or ±0.01 pu, whichever is greater
Undervoltage Inhibit Level:	0.000 to 3.000 pu in steps of 0.001 pu
Accuracy:	±0.5% of reading from 10 to 208V
Pickup delay:	0 to 600.00 s in steps of 0.01
Time accuracy:	±3% or ±20 ms, whichever is greater
Operate time:	< 30 ms at 1.10 x pickup at 60 Hz
TRANSFORMER AGING FACTOR	
Operating quantity:	computed aging acceleration factor (pu)
Pickup level:	1 to 10 pu in steps of 0.1
Pickup delay:	0 to 30000 min. in steps of 1
TRANSFORMER INSTANTANEOUS DIFFERENTIAL	
Pickup level:	2.00 to 30.00 pu in steps of 0.01
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater)
Operate time:	< 20 ms at 3 x pickup at 60 Hz
TRANSFORMER HOTTEST-SPOT TEMPERATURE	
Operating quantity:	computed temperature in °C
Pickup level:	50 to 300°C in steps of 1
Dropout level:	1°C below pickup
Pickup delay:	0 to 30000 min. in steps of 1
TRANSFORMER LOSS OF LIFE	
Operating quantity:	computed accumulated transformer loss of life, in hours
Pickup level:	0 to 500000 hours in steps of 1
TRANSFORMER PERCENT DIFFERENTIAL	
Characteristic:	Differential Restraint pre-set
Number of zones:	2
Minimum pickup:	0.05 to 1.00 pu in steps of 0.001
Slope 1 range:	15 to 100% in steps of 1%
Slope 2 range:	50 to 100% in steps of 1%
Kneepoint 1:	1.0 to 2.0 pu in steps of 0.0001
Kneepoint 2:	2.0 to 30.0 pu in steps of 0.0001
2nd harmonic inhibit level:	1.0 to 40.0% in steps of 0.1
2nd harmonic inhibit function:	Adaptive, Traditional, Disabled
2nd harmonic inhibit mode:	Per-phase, 2-out-of-3, Average
5th harmonic inhibit range:	1.0 to 40.0% in steps of 0.1
Operate times:	
Harmonic inhibits selected:	20 to 30 ms
No harmonic inhibits selected:	5 to 20 ms
Dropout level:	97 to 98% of pickup
Level accuracy:	±0.5% of reading or ±1% of rated (whichever is greater)

PROTECTION	
TRIP OUTPUT	
Collects trip and reclose input requests and issues outputs to control tripping and reclosing.	
Communications timer delay:	0 to 65535 s in steps of 0.001
Evolving fault timer:	0.000 to 65.535 s in steps of 0.001
Timing accuracy:	±3% or 4 ms, whichever is greater
UNDERFREQUENCY	
Minimum signal:	0.10 to 1.25 pu in steps of 0.01
Pickup level:	20.00 to 65.00 Hz in steps of 0.01
Dropout level:	Pickup + 0.03 Hz
Level accuracy:	±0.01 Hz
Time delay:	0 to 65.535 s in steps of 0.001
Timer accuracy:	±3% or 4 ms, whichever is greater
VOLTS PER HERTZ	
Voltage:	Phasor only
Pickup level:	0.80 to 4.00 in steps of 0.01 pu V/Hz
Dropout level:	97 to 98% of Pickup
Level accuracy:	±0.02 pu
Timing curves:	Definite Time; Inverse A, B, and C, FlexCurves A, B, C, and D
TD Multiplier:	0.05 to 600.00 s in steps of 0.01
Reset delay:	0.0 to 1000.0 s in steps of 0.1
Timing accuracy:	±3% or ± 4 ms (whichever is greater)
VT FUSE FAIL	
Monitored parameters:	V ₂ , V ₁ , I ₁
WATTMETRIC ZERO-SEQUENCE DIRECTIONAL	
Measured Power:	Zero-Sequence
Number of Elements:	2
Characteristic Angle:	0 to 360° in steps of 1
Minimum Power:	0.001 to 1.20pu in steps of 0.001
Pickup Level Accuracy:	±1% or ± 0.0025 pu, whichever is greater
Pickup Delay:	Definite time [0 to 600.00 s in steps of 0.01], inverse time, or FlexCurve
Inverse Time Multiplier:	0.01 to 2.00 s in steps of 0.01
Time Accuracy:	±3% or ±8 ms, whichever is greater
Operate Time:	<30 ms at 60 Hz
MONITORING	
DATA LOGGER	
Number of channels:	1 to 16
Parameters:	Any available analog actual value
Sampling rate:	15 to 3600000 ms in steps of 1
Trigger:	Any FlexLogic operand
Mode:	Continuous or Triggered
Storage capacity:	(NN is dependent on memory)
1-second rate:	01 channel for NN days 16 channels for NN days
60-minute rate:	01 channel for NN days 16 channels for NN days
EVENT RECORDER	
Capacity:	1024 events
Time-tag:	to 1 microsecond
Triggers:	Any element pickup, dropout or operate Digital input change of state Digital output change of state Self-test events
Data storage:	In non-volatile memory
FAULT LOCATOR	
Method:	Single-ended
Maximum accuracy if:	Fault resistance is zero or fault currents from all line terminals are in phase
Relay accuracy:	±1.5% (V > 10 V, I > 0.1 pu)
Worst-case accuracy:	VT%error + (user data) CT%error + (user data) ZLine%error + (user data) METHOD%error + (Chapter 6) RELAY ACCURACY%error + (1.5%)
HIGH-IMPEDANCE FAULT DETECTION (HiZ)	
Detections:	Arc Suspected, Arc Detected, Downed Conductor, Phase Identification
OSCILLOGRAPHY	
Maximum records:	64
Sampling rate:	64 samples per power cycle
Triggers:	Any element pickup, dropout or operate Digital input change of state Digital output change of state Any FlexLogic Operand FlexLogic Equation
Data:	AC input channels Element state Digital input state Digital output state
Data storage:	In non-volatile memory
USER-PROGRAMMABLE FAULT REPORT	
Number of elements:	2
Pre-fault trigger:	any FlexLogic. operand
Fault trigger:	any FlexLogic. operand
Recorder quantities:	32 (any FlexAnalog value)



UR Technical Specifications, continued

MONITORING	
PHASOR MEASUREMENT UNIT	
Output format:	per IEEE C37.118 standard
Number of channels:	14 synchrophasors, 16 analogs, 16 digitals
TVE (total vector error):	<1%
Triggering:	frequency, voltage, current, power, rate of change of frequency, user-defined
Reporting rate:	1, 2, 5, 10, 12, 15, 20, 25, 30, 50, 60 or 120 times per second
Number of clients:	One over TCP/IP port, two over UDP/IP ports
TAC ranges:	As indicated in appropriate specifications sections
Network reporting format:	16-bit integer or 32-bit IEEE floating point numbers
Network reporting style:	Rectangular (real and imaginary) or polar (magnitude and angle) coordinates
Filtering:	P and M class
Calibration:	Angle $\pm 5^\circ$, magnitude $\pm 5\%$ per phase
Compensation:	-180 to 180° in steps of 30° (current and voltage components)
Mode of operation:	Normal and test
PMU Recording:	46 configurable channels (14 synchrophasor, 16 digital, 16 analogs)

METERING	
RMS CURRENT: PHASE, NEUTRAL, AND GROUND	
Accuracy at:	
0.1 to 2.0 \times CT rating:	$\pm 0.25\%$ of reading or $\pm 0.1\%$ of rated (whichever is greater)
> 2.0 \times CT rating:	$\pm 1.0\%$ of reading
RMS VOLTAGE	
Accuracy:	$\pm 0.5\%$ of reading from 10 to 208 V
REAL POWER (WATTS)	
Accuracy:	$\pm 1.0\%$ of reading at $-0.8 < PF < -1.0$ and $0.8 < PF < 1.0$

REACTIVE POWER (VARs)	
Accuracy:	$\pm 1.0\%$ of reading at $-0.2 < PF < 0.2$

APPARENT POWER (VA)	
Accuracy:	$\pm 1.0\%$ of reading

WATT-HOURS (POSITIVE AND NEGATIVE)	
Accuracy:	$\pm 2.0\%$ of reading
Range:	± 0 to 2×10^9 MWh
Parameters:	3-phase only
Update rate:	50 ms

VAR-HOURS (POSITIVE AND NEGATIVE)	
Accuracy:	$\pm 2.0\%$ of reading
Range:	± 0 to 2×10^9 Mvarh
Parameters:	3-phase only
Update rate:	50 ms

CURRENT HARMONICS	
Harmonics:	2nd to 25th harmonic; per phase, displayed as a % of f1 (fundamental frequency phasor) THD: per phase, displayed as a % of f1
Accuracy:	
Harmonics:	1. f1 > 0.4pu: (0.20% + 0.035% / harmonic) of reading or 0.15% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1

THD:	1. f1 > 0.4pu: (0.25% + 0.035% / harmonic) of reading or 0.20% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1
------	---

DEMAND	
Measurements:	Phases A, B, and C present and maximum measured currents 3-Phase Power (P, Q, and S) present and maximum measured currents
Accuracy:	$\pm 2.0\%$

FREQUENCY	
Accuracy at	
V = 0.8 to 1.2 pu:	± 0.01 Hz (when voltage signal is used for frequency measurement)
I = 0.1 to 0.25 pu:	± 0.05 Hz
I > 0.25 pu:	± 0.02 Hz (when current signal is used for frequency measurement)

VOLTAGE HARMONICS	
Harmonics:	2nd to 25th harmonic; per phase, displayed as a % of f1 (fundamental frequency phasor) THD: per phase, displayed as a % of f1
Accuracy:	
Harmonics:	1. f1 > 0.4pu: (0.20% + 0.035% / harmonic) of reading or 0.15% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1
THD:	1. f1 > 0.4pu: (0.25% + 0.035% / harmonic) of reading or 0.20% of 100%, whichever is greater 2. f1 < 0.4pu: as above plus %error of f1

USER-PROGRAMMABLE ELEMENTS	
CONTROL PUSHBUTTONS	
Number of pushbuttons:	3 (standard) or 16 (optional)
Operation:	drive FlexLogic operands
FLEXCURVES	
Number:	4 (A through D)
Reset points:	40 (0 through 1 of pickup)
Operate points:	80 (1 through 20 of pickup)
Time delay:	0 to 65535 ms in steps of 1
FLEXLOGIC	
Programming language:	Reverse Polish Notation with graphical visualization (keypad programmable)

Lines of code:	512
Internal variables:	64
Supported operations:	NOT, XOR, OR (2 to 16 inputs), AND (2 to 16 inputs), NOR (2 to 16 inputs), NAND (2 to 16 inputs), Latch (Reset Dominant), Edge Detectors, Timers
Inputs:	any logical variable, contact, or virtual input
Number of timers:	32
Pickup delay:	0 to 60000 (ms, sec., min.) in steps of 1
Dropout delay:	0 to 60000 (ms, sec., min.) in steps of 1

FLEXELEMENTS	
Number of elements:	8 or 16
Operating signal:	any analog actual value, or two values in Differential mode
Operating signal mode:	Signed or Absolute Value
Operating mode:	Level, Delta
Comparator direction:	Over, Under
Pickup Level:	-30,000 to 30,000 pu in steps of 0.001
Hysteresis:	0.1 to 50.0% in steps of 0.1
Delta dt:	20 ms to 60 days
Pickup & dropout delay:	0.000 to 65.535 s in steps of 0.001

FLEXSTATES	
Number:	up to 256 logical variables grouped under 16 Modbus addresses
Programmability:	any logical variable, contact, or virtual input

LED TEST	
Initiation:	from any digital input or user-programmable condition
Number of tests:	3, interruptible at any time
Duration of full test:	approximately 3 minutes
Test sequence 1:	all LEDs on
Test sequence 2:	all LEDs off, one LED at a time on for 1 s
Test sequence 3:	all LEDs on, one LED at a time off for 1 s

NON-VOLATILE LATCHES	
Type:	Set-dominant or Reset-dominant
Number:	16 (individually programmed)
Output:	Stored in non-volatile memory
Execution sequence:	As input prior to protection, control, and FlexLogic.

SELECTOR SWITCH	
Number of elements:	2
Upper position limit:	1 to 7 in steps of 1
Selecting mode:	Time-out or Acknowledge
Time-out timer:	3.0 to 60.0 s in steps of 0.1
Control inputs:	step-up and 3-bit
Power-up mode:	restore from non-volatile memory or synchronize to a 3-bit control input

USER-DEFINABLE DISPLAYS	
Number of displays:	16
Lines of display:	2 \times 20 alphanumeric characters
Parameters:	up to 5, any Modbus register addresses
Invoking and scrolling:	Keypad, or any user-programmable condition, including pushbuttons

USER-PROGRAMMABLE LEDS	
Number:	48 plus Trip and Alarm
Programmability:	from any logical variable, contact, or virtual input
Reset mode:	Self-reset or Latched

USER-PROGRAMMABLE PUSHBUTTONS (OPTIONAL)	
Number of pushbuttons:	12
Mode:	Self-Reset, Latched
Display message:	2 lines of 20 characters each

8-BIT SWITCH	
Number of elements:	6
Input signals:	two 8-bit integers via FlexLogic operands
Control:	any FlexLogic operand
Response time:	< 8 ms at 60 Hz, < 10 ms at 50 Hz

INPUTS	
AC CURRENT	
CT rated primary:	1 to 50000 A
CT rated secondary:	1 A or 5 A by connection
Nominal frequency:	20 to 65 Hz
Relay burden:	< 0.2 VA at rated secondary
Conversion range:	
Standard CT:	0.02 to 46 \times CT rating RMS symmetrical
Sensitive Ground/	0.002 to 4.6 \times CT rating
HI-Z CT module:	RMS symmetrical
Current withstand:	20 ms at 250 times rated 1 sec. at 100 times rated continuous at 3 times rated

AC VOLTAGE	
VT rated secondary:	50.0 to 240.0 V
VT ratio:	1.00 to 24000.00
Nominal frequency:	20 to 65 Hz For the L90, the nominal system frequency should be chosen as 50 Hz or 60 Hz only.
Relay burden:	< 0.25 VA at 120 V
Conversion range:	1 to 275 V
Voltage withstand:	continuous at 260 V to neutral 1 min./hr at 420 V to neutral

CONTACT INPUTS	
Dry contacts:	1000 Ω maximum
Wet contacts:	300 V DC maximum
Selectable thresholds:	17 V, 33 V, 84 V, 166 V
Tolerance:	$\pm 10\%$
Contacts Per	4
Common Return:	
Recognition time:	< 1 ms
Debounce timer:	0.0 to 16.0 ms in steps of 0.5
Continuous Current Draw:	3mA (when energized)

CONTACT INPUTS WITH AUTO-BURNISHING	
Dry contacts:	1000 Ω maximum
Wet contacts:	300 V DC maximum
Selectable thresholds:	17 V, 33 V, 84 V, 166 V
Tolerance:	$\pm 10\%$
Contacts Per	2
Common Return:	
Recognition time:	< 1 ms
Debounce timer:	0.0 to 16.0 ms in steps of 0.5
Continuous Current Draw:	3mA (when energized)
Auto-Burnish	50 to 70 mA
Impulse Current:	
Duration of	25 to 50 ms
Auto-Burnish Impulse:	

DCMA INPUTS	
Current input (mA DC):	0 to -1, 0 to +1, -1 to +1, 0 to 5, 0 to 10, 0 to 20, 4 to 20 (programmable)
Input impedance:	379 $\pm 10\%$
Conversion range:	-1 to +20 mA DC
Accuracy:	$\pm 0.2\%$ of full scale
Type:	Passive

DIRECT INPUTS	
Number of input points:	32
No. of remote devices:	16
Default states on	On, Off, Latest/Off, Latest/On
loss of comms.:	
Ring configuration:	Yes, No
Data rate:	64 or 128 kbps
CRC:	32-bit
CRC alarm:	
Responding to:	Rate of messages failing the CRC
Monitoring message count:	10 to 10000 in steps of 1
Alarm threshold:	1 to 1000 in steps of 1
Unreturned message alarm:	
Responding to:	Rate of unreturned messages in the ring configuration
Monitoring message count:	10 to 10000 in steps of 1
Alarm threshold:	1 to 1000 in steps of 1

IRIG-B INPUT	
Amplitude modulation:	1 to 10 V pk-pk
DC shift:	TTL
Input impedance:	22 k Ω
Isolation:	2 kV

REMOTE INPUTS (IEC 61850 GSSE)	
Number of input points:	32, configured from 64 incoming bit pairs
Number of remote devices:	16
Default states on	On, Off, Latest/Off, Latest/On
loss of comms.:	

RTD INPUTS	
Types (3-wire):	100 Ω Platinum, 100 Ω & 120 Ω Nickel, 10 Ω Copper
Sensing current:	5 mA
Range:	-50 to +250°C
Accuracy:	$\pm 2^\circ\text{C}$
Isolation:	36 V pk-pk



UR Technical Specifications, continued

OUTPUTS																				
CONTROL POWER EXTERNAL OUTPUT (FOR DRY CONTACT INPUT)																				
Capacity:	100 mA DC at 48 V DC																			
Isolation:	±300 Vpk																			
DCMA OUTPUTS																				
Range:	-1 to 1 mA, 0 to 1 mA, 4 to 20 mA																			
Max. load resistance:	12 k for -1 to 1 mA range 12 k for 0 to 1 mA range 600 for 4 to 20 mA range																			
Accuracy:	±0.75% of full-scale for 0 to 1 mA range ±0.5% of full-scale for -1 to 1 mA range ±0.75% of full-scale for 0 to 20 mA range																			
99% Settling time to a step change:	100 ms																			
Isolation:	1.5 kV																			
Driving signal:	any FlexAnalog quantity																			
Upper & lower limit for the driving signal:	-90 to 90 pu in steps of 0.001																			
DIRECT OUTPUTS																				
Output points:	32																			
FORM-A CURRENT MONITOR																				
Threshold current:	approx. 80 to 100 mA																			
FORM-A RELAY																				
Make & carry for 0.2s:	30 A as per ANSI C37.90																			
Carry continuous:	6 A																			
Break at L/R of 40 ms:	1 A DC max. at 24 V 0.5 A DC max. at 48 V 0.3 A DC max. at 125 V 0.2 A DC max. at 250 V																			
Operate time:	< 4 ms																			
Contact material:	Silver alloy																			
FORM-A VOLTAGE MONITOR																				
Applicable voltage:	approx. 15 to 250 V DC																			
Trickle current:	approx. 1 to 2.5 mA																			
<table><tr><th>INPUT VOLTAGE</th><th colspan="2">IMPEDANCE</th></tr><tr><td></td><th>2W RESISTOR</th><th>1W RESISTOR</th></tr><tr><td>250 V DC</td><td>20 K</td><td>50K</td></tr><tr><td>120 V DC</td><td>5 K</td><td>2 K</td></tr><tr><td>48 V DC</td><td>2 K</td><td>2 K</td></tr><tr><td>24 V DC</td><td>2 K</td><td>2 K</td></tr></table>			INPUT VOLTAGE	IMPEDANCE			2W RESISTOR	1W RESISTOR	250 V DC	20 K	50K	120 V DC	5 K	2 K	48 V DC	2 K	2 K	24 V DC	2 K	2 K
INPUT VOLTAGE	IMPEDANCE																			
	2W RESISTOR	1W RESISTOR																		
250 V DC	20 K	50K																		
120 V DC	5 K	2 K																		
48 V DC	2 K	2 K																		
24 V DC	2 K	2 K																		
FORM-C AND CRITICAL FAILURE RELAY																				
Make & carry for 0.2 s:	30 A																			
Carry continuous:	8 A																			
Break at L/R of 40 ms:	0.25 A DC max. at 48 V 0.10 A DC max. at 125 V																			
Operate time:	< 8 ms																			
Contact material:	Silver alloy																			
FAST FORM-C RELAY																				
Make & carry:	0.1 A max. (resistive load)																			
Minimum load impedance:																				
Operate time:	< 0.6 ms																			
Internal Limiting Resistor:	100, 2																			
IRIG-B OUTPUT																				
Amplitude:	10 V peak-peak RS485 level																			
Maximum load:	100 ohms																			
Time delay:	1 ms for AM input 40 µs for DC-shift input																			
Isolation:	2 kV																			
LATCHING RELAY																				
Make & carry for 0.2 s:	30 A as per ANSI C37.90																			
Carry continuous:	6 A																			
Break at L/R of 40 ms:	0.25 A DC max.																			
Operate time:	< 4 ms																			
Contact material:	Silver alloy																			
Control:	separate operate and reset inputs																			
Control mode:	operate-dominant or reset-dominant																			
REMOTE OUTPUTS (IEC 61850 GSSE)																				
Standard output points:	32																			
User output points:	32																			
SOLID-STATE OUTPUT RELAY																				
Operate & release time:	<100 µs																			
Maximum voltage:	265 V DC																			
Maximum continuous current:	5 A at 45°C; 4 A at 65°C																			
Make & carry for 0.2 s:	as per ANSI C37.90																			
For 0.3s:	300 A																			
Breaking capacity:																				

	IEC 647-5/UL508	UTILITY APPLICATION (AUTORECLOSE SCHEME)	INDUSTRIAL APPLICATION
Operations/Interval	5000 ops 1 s-On, 9 s-Off 1000 ops 0.5 s-On, 0.5 s-Off	5 ops/ 2 s-On 0.2 s-Off within 1 minute	10000 ops/ 0.2 s-On 30 s-Off
Break capability (to 250 VDC)	3.2 A L/R = 10 ms 1.6 A L/R = 20 ms 0.8 A L/R = 40 ms	10 A L/R = 40 ms	10 A L/R = 40 ms

COMMUNICATIONS	
RS232	
Front port:	19.2 kbps, Modbus™ RTU, DNP 3.0
RS485	
1 or 2 rear ports:	Up to 115 kbps, Modbus™ RTU, DNP 3.0 isolated together at 36 Vpk
Typical distance:	1200 m
Isolation:	2 kV
ETHERNET PORT	
10Base-F:	820 nm, multi-mode, supports half-duplex/full-duplex fiber optic with ST connector
Redundant 10Base-F:	820 nm, multi-mode, half-duplex/full-duplex fiber optic with ST connector
10Base-T:	RJ45 connector
Power budget:	10 dB
Max optical input power:	-7.6 dBm
Max optical output power:	-20 dBm
Receiver sensitivity:	-30 dBm
Typical distance:	1.65 km
SNTP clock:	<10 ms (typical)
synchronization error:	

	RS232	RS485	10BaseF	10BaseT	100BaseT
IEC 61850			•	•	•
DNP 3.0	•	•	•	•	•
Modbus	•	•	•	•	•
IEC104			•	•	•

INTER-RELAY COMMUNICATIONS	
SHIELDED TWISTED-PAIR INTERFACE OPTIONS	
INTERFACE TYPE	TYPICAL DISTANCE
RS422	1200m
G.703	100m

* NOTE: RS422 distance is based on transmitter power and does not take into consideration the clock source provided by the user.

LINK POWER BUDGET			
EMITTER, FIBER TYPE	TRANSMIT POWER	RECEIVED SENSITIVITY	POWER BUDGET
820nm LED Multimode	-20dBm	-30dBm	10dB
1300 nm LED Multimode	-21dBm	-30dBm	9dB
1300 nm ELED Multimode	-21dBm	-30dBm	9dB
1300 nm Laser Singlemode	-1dBm	-30dBm	29dB
1550 nm Laser Singlemode	+5dBm	-30dBm	35dB

* NOTE: These power budgets are calculated from the manufacturers' worst-case transmitter power and worst-case receiver sensitivity.

MAXIMUM OPTICAL INPUT POWER	
EMITTED, FIBER TYPE	MAX. OPTICAL INPUT POWER
820 nm LED, Multimode	-7.6 dBm
1300 nm LED, Multimode	-11 dBm
1300 nm ELED, Singlemode	-14 dBm
1300 nm Laser, Singlemode	-14 dBm
1500 nm Laser, Singlemode	-14 dBm

TYPICAL LINK DISTANCE			
EMITTED TYPE	FIBER TYPE	CONNECTOR TYPE	TYPICAL DISTANCE
820 nm LED	Multimode	-7.6 dBm	1.65 km
1300 nm LED	Multimode	-11 dBm	3.8 km
1300 nm ELED	Singlemode	-14 dBm	11.4 km
1300 nm Laser	Singlemode	-14 dBm	64 km
1500 nm Laser	Singlemode	-14 dBm	105 km

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INTER-RELAY COMMUNICATIONS	
* Note: Typical distances listed are based on the following assumptions for system loss. Actual losses will vary from one installation to another, the distance covered by your system may vary.	
CONNECTOR LOSSES (TOTAL OF BOTH ENDS)	
ST connector	2dB
FIBER LOSSES	
820 nm multimode	3 dB/km
1300 nm multimode	1 dB/km
1300 nm singlemode	0.35 dB/km
1550 nm singlemode	0.25 dB/km
Splice losses:	One splice every 2 km, at 0.05 dB loss per splice

SYSTEM MARGIN
3 dB additional loss added to calculations to compensate for all other losses.
Compensate difference in transmitting and receiving (channel asymmetry) channel delays using GPS satellite clock: 10 ms

POWER SUPPLY	
LOW RANGE	
Nominal DC voltage:	24 to 48 V at 3 A
Min/max DC voltage:	20 / 60 V
* NOTE:	Low range is DC only.
HIGH RANGE	
Nominal DC voltage:	125 to 250 V at 0.7 A
Min/max DC voltage:	88 / 300 V
Nominal AC voltage:	100 to 240 V at 50/60 Hz, 0.7 A
Min/max AC voltage:	88 / 265 V at 48 to 62 Hz

ALL RANGES	
Volt withstand:	2 × Highest Nominal Voltage for 10 ms
Voltage loss hold-up:	50 ms duration at nominal
Power consumption:	Typical = 15 VA; Max. = 30 VA

INTERNAL FUSE	
RATINGS	
Low range power supply:	8 A / 250 V
High range power supply:	4 A / 250 V
INTERRUPTING CAPACITY	
AC:	100 000 A RMS symmetrical
DC:	10 000 A
Hold up time:	200 ms

TYPE TESTS	
Electrical fast transient:	ANSI/IEEE C37.90.1 IEC 61000-4-4 IEC 60255-22-4
Oscillatory transient:	ANSI/IEEE C37.90.1 IEC 61000-4-12
Insulation resistance:	IEC 60255-5
Dielectric strength:	IEC 60255-6 ANSI/IEEE C37.90
Electrostatic discharge:	EN 61000-4-2
Surge immunity:	EN 61000-4-5
RFI susceptibility:	ANSI/IEEE C37.90.2 IEC 61000-4-3 IEC 60255-22-3 Ontario Hydro C-5047-77
Conducted RFI:	IEC 61000-4-6
Voltage dips/ interruptions/variations:	IEC 61000-4-11 IEC 60255-11
Power frequency magnetic field immunity:	IEC 61000-4-8
Vibration test (sinusoidal):	IEC 60255-21-1
Shock and bump:	IEC 60255-21-2
* NOTE:	Type test report available upon request.

PRODUCTION TESTS	
THERMAL	
Products go through an environmental test based upon an accepted quality level (AQL) sampling process	
ENVIRONMENTAL	
OPERATING TEMPERATURES	
Cold:	IEC 60028-2-1, 16 h at -40°C
Dry Heat:	IEC 60028-2-2, 16 h at +85°C
OTHER	
Humidity(noncondensing):	
	IEC 60068-2-30, 95%, Variant 1,6days.
Altitude:	Up to 2000 m
Installation Category:	II

Approvals	
UL Listed for the USA and Canada	
Manufactured under an ISO9000 registered system.	
CE	LVD 73/23/EEC: IEC 1010-1
EMC 81/336/EEC: EN 50081-2, EN 50082-2	



Relays and Meters Protection & Control SR Family

Comprehensive industrial and utility protective relay systems for motors, generators, transformers, and feeders

Section 22

Key Benefits

- Large backlit display with 40 characters to view relay information and settings in direct sunlight, full numerical keypad, and setpoint navigation keys. (Except 735/737)
- Accurate metering under severe system disturbances (750, 745 & 489) - Power system frequency tracking and adjusting sampling rate accordingly
- Minimize replacement time - Draw-out construction
- Improve uptime of auxiliary equipment - Through I/O monitoring
- Ease of use and installation - same front panel programming, common cutout (Except 735/737)
- Reduce troubleshooting time and maintenance costs -IRIG-B time synchronization, event reports, waveform capture, data logger (Except 735/737)
- Simplify testing - Built in simulation features and unique waveform play back functionality in the 745
- Cost Effective Access information - Via Modbus RTU and DNP 3.0 Level 2 protocols, through standard RS232, RS485 & RS422 serial ports, and optional Modbus RTU over TCP/IP through embedded Ethernet Port to connect to 10MB Ethernet local or wide area networks.
- Complete asset monitoring - Analog I/O, metering including demand & energy (Except 735/737)
- Follow technology evolution - Flash memory for product field upgrade (Except 735/737 that requires an EEPROM replacement)
- Long lasting life - When exposed to chemically corrosive and humid environments with optional conformal coating (Except 735/737)

Applications

- 735/737 - Feeder Protection
- 750/760 - Feeder Protection (comprehensive)
- 469 - Motor Protection
- 745 - Transformer Protection
- 489 - Generator Protection

Features

—Monitoring and Metering

- Event recorder
- Oscillography and Data Logger
- Self diagnostic
- Metering
- Demand



Features (continued)

User Interface and Programming

- Front Panel LEDs, full key pad, and backlit LCD display
- RS232, RS485 and RS422 ports - up to 19,200 bps
- Ethernet port - 10 Mbps
- Multiple protocols - ModBus® RTU, ModBus® RTU over TCP/IP, DNP 3.0 Level 2, Optional Device Net on 469

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the SR relays into new or existing monitoring and control systems



Relays and Meters Protection & Control 650 Family

Advanced Protection Control and Monitoring System

Section 22

Key Benefits

- Unique built-in control features - Comprehensive protection plus programmable logic
- Flexible and cost effective control for complex systems - Use IEC compatible programmable logic to customize the functionality of your protection & control system to address unique, site specific applications
- Human machine interface (HMI) - Standard backlit LCD display with 4 x 20, optional 16 x 40 (240 x 128 pixels) graphical LCD, programmable buttons, and rotary knob for selecting setting menus, and submenus.
- Minimize replacement time - Modular with card draw-out construction
- Reduce troubleshooting time and maintenance costs - IIRIG-B time synchronization, event reports, waveform capture, data logger
- Cost Effective Access information - Via multiple protocols, through standard RS232, & RS485, Ethernet Ports.
- Optimal integration flexibility via open standard protocols - Modbus RTU, DNP 3.0 Level 2, IEC60870-5-104, IEC61850
- Minimize communication down time - Reliable redundant Ethernet Communication ports with 10/100BaseTX, 100BaseFX with ST connectors, and optional double 100BaseFX, with ST connectors
- Complete asset monitoring - Full metering including demand & energy
- Follow technology evolution - Flash memory for product field upgrade

Applications

- F650: Management and primary protection of distribution feeders and bus couplers
- F650: Backup protection of busses, transformers and power lines
- G650: Packaged generator mains failure detection
- G650: Distributed generation management device
- G650: Reliable Distributed Generation interconnection protection system
- W650: Wind turbine protection, control and monitoring
- W650: Distributed generation grid interconnection device

Features

Protection and Control

- Up to 32 Programmable digital inputs
- Up to 16 digital outputs
- Trip Circuit Supervision
- Redundant power supply option
- Configurable PLC logic according to IEC 61131-3
- Fully configurable graphic display HMI interface
- Alarms panel



Features (continued)

Monitoring and Metering

- Energy metering
- Demand metering
- Trip circuit monitoring
- Oscillography
- Data logger
- Sequence of event
- Self diagnostic

User Interface

- Large graphic (16x40) or regular (4x20) character display
- Easy to use control via Shuttle key
- Front RS232
- Rear wire 10/100BaseTX Ethernet for LAN connection.
- Rear wire CAN bus port (OPEN CAN protocol - W650)
- Optional fibre optic 100BaseFX Ethernet, single or redundant.
- Optional rear RS485 port
- 1 ready LED and 15 programmable LED indicators
- EnerVista™ Integrator providing easy integration of data in the 650 relay into new or existing monitoring and control systems
- Energy metering
- Demand metering
- Trip circuit monitoring
- Oscillography
- Data logger
- Sequence of event
- Self diagnostic



Relays and Meters Protection & Control SR 3 Family

Intuitive industrial and utility protective relays systems
for feeders, motors and transformers

Section 22

Key Benefits

- Easy to use and cost effective protection and control for feeders, motors and transformers
- Effortless draw-out construction eliminates requirements for test switches and reduces downtime
- Environmental monitoring system to alarm on destructive operating conditions and plan preventative maintenance
- Easy to use interface and set up in one simple step
- Accelerated Life Cycle Tested to ensure reliability of relay operation under abnormal conditions
- Advanced power system diagnostics to increase reliability through fault and disturbance recording capabilities
- Large backlit display with 40 characters for easy viewing of relay information and settings
- Flexible communications with multiple ports & protocols to allow seamless integration into new and existing infrastructure
- Easy access to information via multiple communication network options including USB, Serial, Fiber & copper Ethernet
- Reduced wiring with support for remote I/O
- Reduce setup and configuration time with the Simplified Motor Setup screen
- Powerful Security Audit Trail tool to increase security and minimize system risks by tracking setting changes

Applications

- 350 Feeder Protection
- 345 Transformer Protection
- 339 Motor Protection



Features

Monitoring and Metering

- Metering and Monitoring
- Event Recorder: 256 events with 1ms time stamping
- Oscillography with 32 samples per cycle and digital states
- IRIG-B clock synchronization
- Relay health diagnostics
- Security audit trail

User Interface and Programming

- 4X20 character LCD display
- Control panel with 12 LED indicators
- Front USB and rear serial, Ethernet and Fiber ports
- Multiple protocols - IEC 61850 GOOSE, ModBus® RTU, ModBus® TCP/IP, DNP 3.0, IEC60870-5-104, IEC60870-5-103, Profibus, DeviceNet

EnerVista™ Software

- EnerVista Software- an industry-leading suite of software tools that simplifies every aspect of working with Multilin devices.
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date



Relays and Meters Protection & Control SR 3 Family

Intuitive industrial and utility protective relays systems
for feeders, motors and transformers

Section 22

Overview

The SR 3 Series protection relays is a highly functional economical protection relay for feeders, motors and transformers. By providing an economical system for protection, control, monitoring and metering, and both local and remote user interfaces in one assembly, the SR 3 Series relays effectively eliminate the need for expensive discrete components.

The SR 3 Series provides detailed diagnostic information allowing users to troubleshoot and minimize downtime. Detailed diagnostics is provided via the 256 1mS time stamped event recorder and the 192 cycle Oscillography report sampled at 32 samples per cycle.

The robust SR 3 Series streamlines user work flow processes and simplifies engineering tasks such as configuration, wiring, testing, commissioning, and maintenance. This cost-effective relay also offers enhanced features such as diagnostics, preventative maintenance, device health reports and advance security features.

Easy to Use

Drawout Construction

The SR 3 Series offers a complete drawout feature eliminating the need for rewiring after testing has been concluded. The withdrawable feature also eradicates the need to disconnect communication cables, e.g. fiber, copper, RJ45, etc and helps retain communication status even after a relay has been withdrawn from its case.

Advanced Communications

Easy integration into new or existing infrastructure

With several Ethernet and serial port options, and a variety of communication protocols, the SR 3 Series provides advanced and flexible communication selections for new and existing applications.

The SR 3 Series supports various industry standard protocols such as, IEC 61850 GOOSE, Modbus RTU, Modbus TCP/IP, DNP3.0, IEC 60870-5-104 and IEC 60870-5-103 providing simplified and easy integration into new and existing applications.

Enhanced Diagnostics

Preventative Maintenance

The SR 3 Series allows users to track relay exposure to extreme environmental conditions by monitoring and alarming at high temperatures. This data allows user to proactively schedule regular maintenance work and upgrade activities.



All relays utilize EnerVista™ setup software for communication, monitoring and metering. Actual values, setpoints, status, trending, and waveform capture information may all be viewed via the software, and can be used for troubleshooting.

Security

Security Audit Trail

The SR 3 Series monitors security and reliability of asset protection. The SR 3 Series protection devices offer complete traceability of any relay setting and command changes allowing the user to quickly identify changes made to the relay.

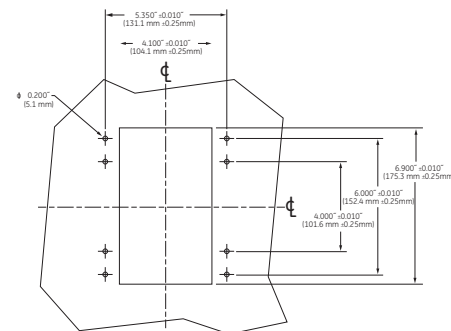
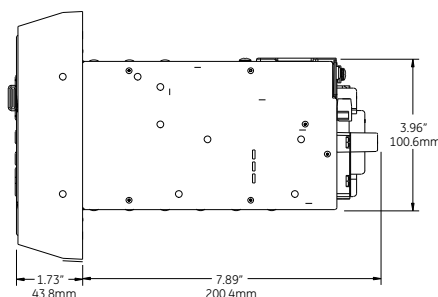
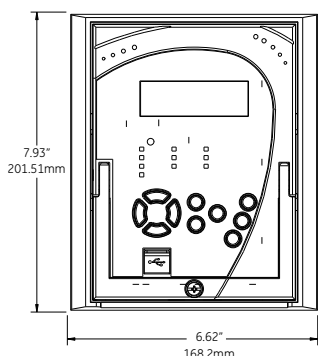
EnerVista™ Launchpad

EnerVista™ Launchpad is a complete set of powerful device setup and configuration tools that is included at no extra charge with the SR Relays.

- Set up the SR Relays - and any other -Multilin device - in minutes. Retrieve and view oscillography and event data at the click of a button.
- Build an instant archive on any of the latest Multilin manuals, service advisories, application notes, specifications or firmware for your SR Relay.
- Automatic document and software version updates via the Internet and detailed e-mail notification of new releases.

Dimensions

Overall dimensions on 350, 339 and 345 are identical. Terminal configurations vary and are not shown.



Relays and Meters Protection & Control MII Family

Modular Microprocessor Family

An economical choice for standard digital relaying applications

Section 22

Key Benefits

- Ease of use and installation - same front panel programming, common cutout
- Follow technology evolution - Flash memory for product field upgrades
- Low priced scalable options - event reports, waveform capture, recloser, breaker fail
- Reduce troubleshooting and maintenance cost - Event reports, waveform capture
- Design flexibility - Easy to use programming logic
- Asset monitoring - Breaker health, and breaker failure protection
- Access to information - Modbus RTU communications
- AC/DC power supply
- Easy access via front panel keypad or communication links

Applications

- Feeder protection
- Main protection for small generators and motors
- Backup/Auxiliary protection for transformers, motors, generators and busbars
- Overload protection
- Automatic transfer equipment
- Load shedding and restoration schemes
- Backup directional overcurrent protection
- Reverse power protection
- Synchrocheck



Features

Features and Benefits

- Digital relay
- Incorporates protection, and control
- Local and remote user interfaces
- Internal memory
- Diagnostic features - event recording, and oscillography

User Interface and Programming

- Front Panel LEDs, key pad, and 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps

Monitoring and Metering

- Current, voltage, frequency, thermal image
- Analog/digital oscillography (optional)
- Event recording up to 32 events
- Self-diagnostics

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in MII relays into new or existing monitoring and control systems



MII Family Feature Comparison

Features		Device	MIF II	MIG II	MIN II	MIV II	MIW II	MIB
Protection	Phase Undervoltage	27P				■		
	Directional Low Forward Power	32L					■	
	Directional Reverse Power	32R					■	
	Loss of Excitation	40					■	
	Current Unbalance	46		■				
	Voltage Unbalance	47				■		
	Thermal Image Unit	49	■	■				
	Ground Overvoltage	59N				■		
	Ground IOC	50G	■	■	■			
	Phase IOC	50P	■	■				
	Ground TOC	51G	■	■	■			
	Phase TOC	51P	■	■				
	Phase Overvoltage	59P				■		
	Fuse Failure	VTFF					■	
	Ground Directional	67G			■			
	Isolated Ground Directional	67N			■			
	Petersen Coil Ground Directional	67PC			■			
	Loss of Mains	78						
	Overfrequency	81O				■		
	Underfrequency	81U				■		
	Starts per Hour and Locked Rotor			■				
	Undercurrent	37		■				
	Differential Unit	87						■
	Restricted Earth Fault	87RGF		■				■
	Breaker Failure Protection	50BF	O					
Monitoring and Metering	Programmable I/O and LEDs		O	■	■	■	■	■
	Breaker Arcing Current		O					
	Programmable Logic		O	■	■	■	■	■
Communications	Multiple Settings Groups		■	■	■	■	■	■
	Event Recorder		O	■	■	■	■	■
	Oscillography		O	■	■	■	■	■
	Thermal Capacity		■	■				
	Alphanumeric Display		■	■	■	■	■	■
	Three-Button Keypad		■	■	■	■	■	■
	ModBus® Communications		■	■	■	■	■	■
	RS232 Serial Port		■	■	■	■	■	■
	RS485 Serial Port		■	■	■	■	■	■



Relays and Meters

Protection & Control

MII Modular Microprocessor Family

Common Technical Specifications

Section 22

Protection

Phase Time Overcurrent

Pickup level:	10 – 240% of CT rating
Curve shapes:	Definite time, inverse, very inverse, extremely inverse, custom
Time multiplier:	0.05 – 2.00 in steps of 0.01
Definite time:	Up to 99.99 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

Ground Time Overcurrent

Pickup level:	10 – 240% of CT rating
Curve shapes:	Definite time, inverse, very inverse, extremely inverse, custom
Time multiplier:	0.05 – 2.00 in steps of 0.01
Definite time:	Up to 99.99 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

Phase Instantaneous

Pickup level:	10 – 3000% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

Ground Instantaneous

Pickup level:	10 – 3000% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

Ground Directional

Torque angle:	-90°, +90° (1° steps)
Direction:	Forward/back (rew)
Loss of voltage polarization logic:	Enable/disable

Isolated Ground Directional (MIN Option S)

Voltage pickup levels:	Vh 2 – 70 V in steps of 0.01 V Vi 2 – 70 V in steps of 0.01 V
Current pickup levels:	I low 5 – 400 mA in steps of 1 mA I hi 5 – 400 mA in steps of 1 mA
Definite time:	0 – 99.99 sec in steps of 10 msec
Instantaneous trip deviation time:	0 – 99.99 sec in steps of 100 msec
Torque angle:	-90°, +90° (1° steps)

Petersen Coil Ground Directional

Voltage pickup levels:	Vh 2 – 45 V in steps of 0.1 V
Current pickup levels:	I low 5 – 100 mA in steps of 1 mA
Real power pickup levels:	10 – 4500 mW in steps of 0.1 mW
Definite time:	0.03 – 3 sec in steps of 10 msec
Instantaneous trip deviation time:	1 – 10 sec in steps of 100 msec
Torque angle:	-90, +90 (0.01 steps)

Directional Reverse Power

Power pickup level:	0.01 – 0.99 x Rated MW
Time delay:	0.2 – 120 seconds in steps of 0.1
Block from online:	0 – 5,000 sec.

Directional Low Forward Power

Power pickup level:	0.01 – 0.99 x Rated MW
Time delay:	0.2 – 120 seconds in steps of 0.1
Block from online:	0 – 15,000 sec.

Loss of Excitation

Circle 1 diameter:	2.5 – 300 ohm
Circle 1 offset:	2.5 – 150 ohm
Circle 1 trip delay:	0.1 – 10 sec
Circle 2 diameter:	2.5 – 300 ohm
Circle 2 offset:	2.5 – 150 ohm
Circle 2 trip delay:	0.1 – 10 sec

Thermal Image Unit

Tap current:	10 – 240% of CT rating
Cool rate:	
T1	3 – 600 min
T2	1 – 6 x T1
K	1 – 1.2
Alarm level:	70 – 100%

Phase Undervoltage

Pickup level:	2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms

Phase Overvoltage

Pickup level:	2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms

Ground Overvoltage

Pickup level:	2.0 – 60 V or 10 – 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms

High Impedance

Differential Unit

Pickup Level:	10mA to 400mA
Definite Time:	Up to 600 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

Alarm Unit

Pickup Level:	10mA to 400mA
Definite Time:	Up to 600 sec (10 msec steps)
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25ms

Voltage Unbalance

Pickup level:	2.0 to 60 V or 10 to 250 V in steps of 0.1 (depending on model)
Curve shapes:	Definite time
Time delay:	0.0 to 600 sec in steps of 0.01
Accuracy:	
Level:	±3% over the complete range
Time:	Greater of ±3% or ±25 ms



Relays and Meters

Protection & Control

MII Modular Microprocessor Family

Common Technical Specifications

Section 22

Overfrequency

Source:	Voltage (Phase B)
Pickup level:	42.0 to 67.5 Hz in steps of 0.01 Hz
Time delay:	0.0 to 600 sec in steps of 0.01
Voltage inhibit setting:	30 to 250 V/10 to 60 V in steps of 0.01

Underfrequency

Source:	Voltage (phase B)
Pickup level:	42.0 to 67.5 Hz in steps of 0.01 Hz
Time delay:	0.0 to 600 sec in steps of 0.01
Voltage inhibit setting:	30 to 250 V/10 to 60 V in steps of 0.01

Current Unbalance

Pickup level:	5 – 99% of CT rating
Definite time:	Up to 99.99 sec (10 msec steps)
Curve shapes:	I ² t = K
Time multiplier:	K: 1 – 100
Accuracy:	
Level:	±3% in the complete range
Time:	Greater of ±3% or ±25 ms

Starts/Hour and Locked Rotor

Pickup level:	101 – 1000% of CT rating
Definite time:	0.1 – 99.9 sec
Time window:	10 – 100 min
Number of starts:	1 – 10
Restart block time:	10 – 100 min

Undercurrent

Pickup level:	10 – 99% of CT rating
Definite time:	0 – 99.99 sec

Metering

Frequency:	±5m Hz
Voltage/current:	±3% over the complete range

Thermal Capacity

Current circuits:	
Continuously:	4 x In
During 3 sec:	50 x In
During 1 sec:	100 x In monitoring (optional)

Monitoring (Optional)

Oscillography

Records:	1 x 24 cycles
Sampling rate:	8 samples per power frequency cycle
Triggers:	Any element pickup or operate Digital input change of state Digital output change of state Communication command
Data:	AC input channels Digital input/output channels Self-test events

Event Recorder

Capacity:	24 events (32 in MIF)
Time-tag:	To 1 millisecond
Triggers:	Any element pickup, operate or reset Digital input/output change of state Self-test events

Ranges

Current:	0.2 – 30 x In
Voltage:	Pickup level

Outputs

Tripping Contacts

Contact capacity:	
Max. operating voltage:	400 VAC
Continuous current:	16 A
Make and carry:	30 A
Breaking:	4000 VA

Output Relays

Configuration:	6 electromechanical Form C
Contact material:	silver alloy suited for inductive loads
Operate time:	8 ms

Max ratings for 100000 operations:

	Voltage	M/C cont.	M/C 0.2 sec	Break	Max Load
DC Resistive	24 VDC	16 A	48 A	16 A	384 W
	48 VDC	16 A	48 A	2.6 A	125 W
	125 VDC	16 A	48 A	0.6 A	75 W
	250 VDC	16 A	48 A	0.5 A	125 W
DC Inductive	24 VDC	16 A	48 A	8 A	192 W
	48 VDC	16 A	48 A	1.3 A	62 W
	125 VDC	16 A	48 A	0.3 A	37.5 W
	250 VDC	16 A	48 A	0.25 A	62.5 W
(L/R = 40 ms)					
AC Resistive	120 VAC	16 A	48 A	16 A	1920 VA
	250 VAC	16 A	48 A	16 A	4000 VA
AC Inductive PF=0.4	120 VAC	16 A	48 A	6 A	720 VA
	250 VAC	16 A	48 A	5 A	1250 VA

Inputs

AC Current

Secondary Rated Current:	1m 5 A depending on the selected model, or 50 mA for sensitive ground models
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ In = 5A secondary < 0.08 VA @ In = 1A secondary < 0.08 VA @ In = 1A sensitive ground, secondary
Current Withstand:	4 x In continuously 100 x In for 1 sec.

AC Voltage

High Range	
Secondary Rated Voltage:	50-240 Vac
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ 120 Vac
Voltage Withstand:	440 Vac continuously
Low Range	
Secondary Rated Voltage:	20-60 Vac
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ 120 Vac
Voltage Withstand:	250 Vac continuously

Digital Inputs

High Range	
Voltage Threshold:	75 Vdc
Maximum Voltage:	300 Vdc
Relay Burden:	5 mA @ 300 Vdc
Low Range	
Voltage Threshold:	12 Vdc
Maximum Voltage:	57 Vdc
Relay Burden:	2 mA @ 57 Vdc



Relays and Meters Protection & Control MII Modular Microprocessor Family

Common Technical Specifications

Section 22

Communications

Local communication:	Alphanumeric display; 3 button frontal keypad
Remote communication(local or remote PC and communications net):	
Mode:	ModBus™ RTU
Speed:	300 to 19,200 bps

Power Supply

Low Range

Rated DC Voltage:	24 to 48 Vdc
Min./Max. DC Voltage:	19 / 58 Vdc

High Range

Rated DC Voltage:	110 to 250 Vdc
Min./Max. DC Voltage:	88 / 300 Vdc
Rated AC Voltage:	110 to 230 Vac @ 50 – 60 Hz
Min./Max. AV Voltage:	88 / 264 Vac @ 50 – 60 Hz
Power Consumption:	Max. = 10 W
Backup time:	(date, time and log memory) without power supply voltage >1 week

Mechanical Characteristics

—Metallic package in quarter 19" rack and four units high
—Frontal MMI with display and keypad
—DB9 connector for RS232 ports on the front (1) and RS485 on the rear
—Protection class IP52 (according to IEC 529)

Environmental

Temperature	
Storage:	-40° C to +80° C
Operation:	-20° C to +60° C
Humidity:	Up to 95% without condensing

Type Tests

Test	Standard	Class
Insulation Test Voltage:	IEC 60255-5	2kV, 50/60 Hz 1 min
Surge Test Voltage:	IEC 60255-5	5 kV, 0.5 J. (3 positive pulses and 3 negative.)
1 MHz Interference:	IEC 60255-22-1	III
Electrostatic Discharge:	IEC 60255-22-2 EN 61000-4-2	IV 8 kV in contact, 15 kV through air
Radio interference:	IEC 60255-22-3: 40 MHz, 151 MHz, 450 MHz and cellular phone	III
Radiated Electromagnetic fields with amplitude modulation.	ENV 50140	10 V/m
Radiated Electromagnetic fields with amplitude modulation Common mode	ENV 50141	10 V/m
Radiated Electromagnetic fields with frequency modulation.	ENV 50204	10 V/m
Fast Transients:	ANSI/IEEE C37.90.1 IEC 60255-22-4 BS EN 61000-4-4	IV IV IV
Magnetic fields at industrial frequency:	EN 61000-4-8	30 A/m
Power Supply interruptions:	IEC 60255-11	
Temperature:	IEC 57 (CO) 22	
RF Emission:	EN 55011	B
Sinusoidal Vibration:	IEC 60255-21-1	II
Shock:	IEC 60255-21-2	I
Insulation Test:	IEC255-5 (Tested on CTs, Power Supply terminals, Contact Inputs and Contact Outputs)	

Packaging

Approximate weight:	Two 4-rack	One 8-rack
Net:	8.8 lbs (4 kgs)	3.9 lbs (2.7 kg)
Ship:	9.9 lbs (4.5 kgs)	7 lbs (3.2 kg)

Approvals

ISO:	Manufactured under an ISO9001 registered system.
CE:	Conforms to 89/336/CEE and 73/23/CEE

*Specifications subject to change without notice.



Generator Protection Selector Guide

page 22-23

Complete generator protection comparison

A reference table highlighting the feature set for each protection system

G60

page 22-24

Comprehensive protection for generators

The G60 Generator Protection System provides comprehensive protection for medium and large generators, including large steam and combustion turbines, combined-cycle generators and multi-circuit hydro units. The G60 may also be used on pumped storage generators without the need of switching the CT secondary circuitry.



G30

page 22-26

Protection of small to medium sized generators and unit transformers

The G30 Generator Protection System provides economical protection for small to medium sized steam, hydraulic and combustion-turbine generators as well as for applications that have both the generator and transformer in the same zone of protection. The G30 is ideal for protecting single and multi-pole generators with single or split phase windings configurations.



489

page 22-28

Protection, monitoring and metering for industrial generators

The 489 Generator Protection System provides complete protection of small to medium sized synchronous or induction generators operating at 25, 50 or 60 Hz. The 489 has specific features required for industrial environments including a drawout case to limit downtime during maintenance as well as conformal coating for protection from harsh chemical environments.



G650

page 22-30

Protection for distributed generation applications

The G650 is a distributed generation protection and control system designed to protect and control small to medium size generators, as well as to operate as a distributed generation interconnection protection system.



W650

page 22-32

Advanced wind turbine protection and control system

The W650 Wind Generator Protection System provides economical protection and control of medium to large sized wind turbine generators. The W650 has unique communication and control functionality that drastically reduce the installation costs associated with the coordination of wind turbine protections and system control.



MIG II

page 22-34

Protection for small generators

The MIG II provides a cost effective solution for providing basic protection for rotating electrical machines. The primary application is for the protection of small generators, however the MIG II contains protection elements such as thermal image protection that can be used for protection of small induction motors.



MIW II

page 22-35

Directional power and loss of excitation protection

The MIW II provides directional power and loss of field protection to prevent motoring and detection of loss of excitation on synchronous generators.



Relays and Meters

Protection and Control

Generator Protection Selection Guide

Section 22

Features	Device	MIWII	MIGII	W650	G650	489	G30	G60
Protection & Control								
Overspeed	12					•		•
Distance Backup	21P					•		•
Volts/Hz	24				•	•	•	•
Synchronism check	25				•	•	•	•
Phase/Ground/Auxiliary Undervoltage	27P/G/A			P/A	P/A	P	P/A	P/A
Third Harmonic Neutral Undervoltage	27TN					•	•	•
Directional Power	32	•		•	•	•	•	•
Undercurrent	37		•					
Bearing RTD	38					•	•	•
Loss of Field	40	•			•	•	•	•
Generator Unbalance	46		•		•	•	•	•
Voltage phase reversal	47			•	•	•		
Thermal Overload	49		•		•	•		
Accidental Energization	50/27				•	•	•	•
Negative Sequence Overcurrent	50 2/51 2			•	•	•		
Instantaneous Overcurrent Phase/Ground/Neutral	50P/G/N		P/G	P/G/N	P/G/N	P/G	P/G/N	P/G/N
Timed Overcurrent Phase/Ground/Neutral	51P/G/N		P/G	P/G/N	P/G/N	P/G	P/G/N	P/G/N
Split Phase	50SP						•	•
Voltage Restraint Overcurrent	51V			•	•	•	•	•
Breaker Failure	50BF			•	•	•		
Power Factor Limiting	55				•			
Overvoltage Phase/Ground/Neutral/Auxiliary	59 P/G/N/A			P/N/A	P/G/N/A	P/N		P/N/A
100% Stator Earth Fault	27TN/59N					•		•
Voltage Unbalance	60V	•		•				
Directional Overcurrent Phase/Ground/Neutral/Neg. Seq.	67P/G/N/Q			P/G/N	G/N	G	P/N/Q	P/N/Q
Power Swing Blocking	68							•
Out of Step Tripping	78							•
Voltage Surge/Loss of Mains	78V				•			
Autoreclose	79			•				
Under/Overfrequency	81U/O			•	•	•	•	•
Rate of Change of Frequency	81R				•	•	•	•
Lockout	86				•		•	•
Generator Differential	87G					•		•
Generator & Transformer Differential	87GT						•	
Restricted Ground Fault	87RGF		•		•		•	•
VT Fuse Failure	VTFF			•	•	•	•	•
Automation								
Contact Inputs (max)		2	2	64	64	7	96	96
Contact Outputs (max)		6	5	16	16	6	64	64
Analog Inputs				16	16	4	24	24
Analog Outputs						4	4	2
RTD Inputs						12	24	24
Virtual Inputs				32	32		64	64
Direct Inputs							32	32
Programmable Logic		•	•	•	•		•	•
FlexElements							•	•
Trip-Coil Supervision				•	•	•	•	•
User-Programmable LED's				•	•		•	•
User-Programmable Pushbuttons				•	•		•	•
Selector Switch							•	•
Digital Counters							•	•
Digital Elements							•	•
Redundant Power Supply				•	•		•	•
Monitoring & Metering								
Current		•	•	•	•	•	•	•
Voltage		•		•	•	•	•	•
Frequency				•	•	•	•	•
Power Factor				•	•	•	•	•
Power - Real, Reactive, Apparent		•		•	•	•	•	•
Energy				•	•	•	•	•
Demand - Current, MW, MVA, Mvar				•	•	•	•	•
Temperature							•	•
Event Recorder (number of events)		24	24	479	479	256	1024	1024
Oscillography (max samples per cycle)		8	8	72	72	12	64	64
Fault Reports				•	•		•	•
Data Logger (max sample rate)				1s	1s	5s	15ms	15ms
Communications								
RS232/RS485 serial communications		•	•	•	•	•	•	•
Ethernet Communications				•	•	•	•	•
Fiber Optic Ethernet				•	•		•	•
Modbus Protocol		•	•	•	•	•	•	•
Protocols								
DNP 3.0 Protocol				•	•	•	•	•
EGD Protocol							•	•
IEC 61870-5-105 protocol							•	•
IEC61850 protocol				•			•	•
Peer-to-Peer Communications (GSSE/GOOSE)				•			•	•
Simple Network Timesync Protocol				•	•		•	•
IRIG-B Input				•	•	•	•	•
Process Bus (IEC 61850-9-2)							•	•



Relays and Meters

Protection and Control

G60 Generator Protection System

Comprehensive protection for generators

Section 22

Key Benefits

- Secure, high-speed protection elements for complete generator protection, compliant with IEEE® C37.102
- Phasor Measurement Unit (synchrophasor) according to IEEE C37.118 (2011) and IEC® 61850-90-5 support
- Three independent fiber or copper Ethernet ports for simultaneous/dedicated network connections with advanced 1 micro-second time synchronization via LAN with IEEE 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Available Ethernet Global Data (EGD) eases integration with new and existing GE Digital Energy control systems
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- Advanced fault and disturbance recording, including internal relay operating signals, eliminating the need for external recording devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Medium to large generators typically driven by steam, gas or hydraulic turbines
- Pumped storage generators used as pumping motors for reservoir storage
- Stand-alone protection or component in automated substation control systems
- Standard protection product offering on new GE generator installations

Features

Protection and Control

- Generator stator differential
- 100% stator ground protection 3rd harmonic
- Field ground protection
- 100% stator ground fault protection using sub-harmonic injection
- Loss of excitation
- Power swing blocking and out-of-step tripping
- Backup distance
- Reverse/low forward power
- Restricted ground fault and thermal overload protection
- Overexcitation
- Generator unbalance
- CT failure for each CT bank, VT fuse failure
- Breaker failure



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip (DTT) and I/O extension applications

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Advanced relay health diagnostics
- P & M class synchrophasors of voltage, current and sequence components: 1 to 120 frames/sec

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the G60 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

G60 Generator Protection System

Comprehensive protection for generators

Section 22

Ordering

G60 - * 00 - H * - F ** - H ** - M ** - P ** - U ** - W/X **										For full size
Base Unit	G60	E								Base Unit
CPU		G								RS485 + RS485 (IEC 61850 option not available)
		H								RS485 + multimode ST 10BaseF
		J								RS485 + multimode ST Redundant 10BaseF
		K								RS485 + multimode ST 100BaseFX
		N								RS485 + multimode ST Redundant 100BaseFX
		T								RS485 + 10/100 BaseT
		U								RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
		V								RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)			00							RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
			01							No Software Options
			03							Ethernet Global Data (EGD)
			04							IEC 61850
			05							Ethernet Global Data (EGD) + IEC 61850
			06							Phasor Measurement Unit (PMU)
			A0							IEC 61850 + Phasor Measurement Unit (PMU)
			B0							CyberSentry UR Lvl 1. Req UR FW 7.xx or higher
			C0							IEEE 1588. Req UR FW 7.xx or higher
			D0							PRP
Mount / Coating				H						IEEE 1588 + CyberSentry UR. Req UR FW 7.xx or higher
				A						Horizontal (19" rack) - Standard
				V						Horizontal (19" rack) - Harsh Environment Coating
				B						Vertical (3/4 size) - Standard
User Interface					K					Vertical (3/4 size) - Harsh Environment Coating
					L					Enhanced English Front Panel
					M					Enhanced English Front Panel with User-Programmable Pushbuttons
					N					Enhanced French Front Panel
					O					Enhanced French Front Panel with User-Programmable Pushbuttons
					P					Enhanced Russian Front Panel
					Q					Enhanced Russian Front Panel with User-Programmable Pushbuttons
					T					Enhanced Chinese Front Panel
					U					Enhanced Chinese Front Panel with User-Programmable Pushbuttons
					V					Vertical Front Panel with English display
					W					Enhanced Turkish Front Panel
					X					Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)						H				125 / 250 V AC/DC
						L				125/250 V AC/DC with redundant 125/250 V AC/DC
CT/VT DSP							8L			24 - 48 V (DC only)
							8M			Standard 4CT/4VT w/ enhanced diagnostics
							8N			Sensitive Ground 4CT/4VT w/ enhanced diagnostics
							8R			Standard 8CT w/ enhanced diagnostics
IEC 61850 Process Bus								81		Sensitive Ground 8CT w/ enhanced diagnostics
Digital I/O									XX	8 Port IEC 61850 Process Bus Module
									4A	No module
									4C	4 Solid State (No Monitoring) MOSFET Outputs
									4D	4 Solid State (Current w/opt Voltage) MOSFET Outputs
									4L	16 Digital Inputs with Auto-Burnish
									67	14 Form-A (No Monitoring) Latchable Outputs
									6C	8 Form-A (No Monitoring) Outputs
									6D	8 Form-C Outputs
									6E	16 Digital Inputs
									6F	4 Form-C Outputs, 8 Digital Inputs
									6K	8 Fast Form-C Outputs
									6L	4 Form-C & 4 Fast Form-C Outputs
									6M	2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
									6N	2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
									6P	4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
									6R	6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
									6S	2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
									6T	2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
									6U	4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
									6V	6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O									5A	2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
									5C	4 dcmA Inputs, 4 dcmA Outputs
									5D	8 RTD Inputs
									5E	8 RTD Inputs, 4 dcmA Outputs
									5F	4 dcmA Inputs, 4 RTD Inputs
Inter-Relay Communications									7A	8 dcmA Inputs
									7B	820 nm, multimode, LED, 1 Channel
									7C	1300 nm, multimode, LED, 1 Channel
									7D	1300 nm, singlemode, ELED, 1 Channel
									7E	820 nm, multimode, LED, 2 Channels
									7F	1300 nm, multimode, LED, 2 Channels
									7G	1300 nm, singlemode, ELED, 2 Channels
									7H	G.703, 2 Channels
									7I	RS422, 2 Channels
									7J	IEEE C37.94, 820 nm, multimode, LED, 1 Channel
									7K	IEEE C37.94, 820 nm, multimode, LED, 2 Channel

Ordering Notes: 1. To view all available model order codes, options for G60 or to order the UR Classic Front Panel, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=G60>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Accessories for the G60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

G30 Generator Protection System

Section 22

Protection for Small to Medium Generators, Combined Generators and Transformers

Key Benefits

- Complete protection for small to medium-sized generators
- Advanced automation capabilities for providing customized protection and control solutions
- Combined generator and transformer protection
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 micro-second time synchronization via LAN with IEEE® 1588 support
- High-speed peer-to-peer communications reduces relay-to-relay wiring and associated installation costs
- Embedded IEC® 61850 protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- High-end fault and disturbance recording eliminates the need for redundant recording devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Small to medium-sized generators typically driven by steam, gas or hydraulic turbines
- Pumped storage generators
- Combined generator and transformer in the zone of protection
- Distributed Generator (DG) interconnect protection as per IEEE 1547

Features

Protection and Control

- Overall unit differential including transformer
- Restricted ground fault and thermal overload protection
- Split-phase protection
- Loss of excitation, overexcitation
- Third harmonic neutral undervoltage
- Generator unbalance
- Reverse and low forward power
- Accidental energization
- Synchronism check
- Phase sequence reversal for pumped storage
- CT failure for each CT bank, VT fuse failure



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for transformer tripping applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to G30 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the G30 into new or existing monitoring and control systems



Relays and Meters Protection and Control G30 Generator Protection System

Protection for Small to Medium Generators, Combined Generators and Transformers

Section 22

Ordering

	G30 - * 00 - H * - F ** - H ** - M ** - P ** - U ** - W/X **														For Full Sized Horizontal Mount	
Base Unit	G30															Base Unit
CPU	E G H J K N T U V	00 01 03 04 A0 B0 C0 D0													RS485 + RS485 (IEC 61850 option not available) RS485 + Multimode ST 10BaseF RS485 + Multimode ST Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 BaseT RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher	
Software Options (see note 1 below)		00 01 03 04 A0 B0 C0 D0													No Software Options Ethernet Global Data (EGD) IEC 61850 Ethernet Global Data (EGD) + IEC 61850 CyberSentry UR Lvl 1. Req UR FW 7.xx or higher IEEE 1588. Req UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry. Req UR FW 7.xx or higher	
Mount / Coating			H A V B													Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Environment Coating Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Environment Coating
User Interface				K L M N O T U V F W Y											Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons	
Power Supply (see note 2 below)				H L											RH 125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only)	
CT/VT DSP					8L 8M 8N 8R			8L 8M 8N 8R							Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive ground 8CT w/ enhanced diagnostic	
IEC 61850 Process Bus							81							XX	8 Port IEC 61850 Process Bus Module	
Digital I/O					4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V	4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs				
Transducer I/O					5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	5C 5E 5F	8 RTD Inputs 4 dcma Inputs, 4 RTD Inputs 8 dcma Inputs	
Inter-Relay Communications															7A 820 nm, multimode, LED, 1 Channel 7B 1300 nm, multimode, LED, 1 Channel 7C 1300 nm, singlemode, ELED, 1 Channel 7H 820 nm, multimode, LED, 2 Channels 7I 1300 nm, multimode, LED, 2 Channels 7J 1300 nm, singlemode, ELED, 2 Channels 7R G.703, 1 Channels 7S G.703, 2 Channels 7T RS422, 1 Channels 7W RS422, 2 Channels 76 IEEE C37.94, 820 nm, multimode, LED, 1 Channel 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel 2A C37.94SM, 1300nm singlemode, ELED, 1 Channel singlemode 2B C37.94SM, 1300nm singlemode, ELED, 2 Channel singlemode	

Ordering Note: 1. To view all the options available for G30, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=G30>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Visit GEMultilin.com/G30 to:

- View Guideform specifications
- Download the instruction manual
- Review application notes and support documents
- Buy a G30 online
- View the UR Family brochure

Accessories for the G30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

489 Generator Protection System

Economical protection, monitoring and metering for generators

Section 22

Key Benefits

- Complete, secure protection of small to medium sized generators
- Easy to use generator protection system supported by an industry leading suite of software tools.
- Advanced protection and monitoring features including the use of RTDs for stator and bearing thermal protection and Analog Inputs for vibration monitoring
- Global acceptance as a member of the most renowned protection relay product family in the market.
- Draw-out construction allowing for minimized downtime and easy removal/installation of the 489 during maintenance routines
- Large, user-friendly front panel interface allowing for realtime power monitoring and setpoint access with a display that is easily readable in direct sunlight
- Enhanced generator troubleshooting through the use of IIRIGB time synchronized event records, waveform capturing, and data loggers
- Simplified setpoint verification testing using built in waveform simulation functionality
- Cost effective access to information through industry standard communication hardware (RS232, RS485, 10BaseT Ethernet) and protocols (Modbus RTU, Modbus TCP/IP, DNP 3.0)
- Available for use in most extreme harsh locations with the available Harsh Chemical Environment Option

Applications

- Synchronous or induction generators operating at 25Hz, 50Hz or 60Hz
- Primary or backup protection in cogeneration applications

Features

Protection and Control

- Generator stator differential
- 100% stator ground
- Loss of excitation
- Distance backup
- Reverse power (anti-motoring)
- Overexcitation
- Ground directional overcurrent
- Inadvertent energization
- Breaker failure
- Stator and bearing thermal monitoring
- Stator and bearing vibration monitoring
- Negative sequence overcurrent

Communications

- Networking interfaces - RS232, RS485, 10Mbps copper Ethernet
- Multiple protocols - ModBus® RTU, ModBus® TCP/IP, DNP 3.0 Level 2



Features (continued)

Monitoring and Metering

- Metering – current, voltage, power, Energy, frequency, power factor
- Demand – current, watts, vars, VA
- Temperature – 12 RTD inputs
- Vibration and Speed – 4 analog transducer inputs
- Event Recorder – 256 time tagged events
- Oscillography – 12 samples/ cycle up to 128 cycles in length
- Trending – 8 parameters with up to a 5 second sample rate

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- Ease to use real time monitoring, control, and data archiving software available
- EnerVista™ Integrator providing easy integration of data in the 489 into new or existing monitoring and control systems



Relays and Meters

Protection & Control

489 Generator Protection System

Economical protection, monitoring and metering for generators

Section 22

Ordering

489	*	*	*	*	*
I					
P1					
P5					
	LO				
	HI				
		A1			
		A20			
			E		
			T		
Current Input Relays					
1 A phase CT secondaries					
5 A phase CT secondaries					
Power Supply Options					
DC: 24 – 60 V; AC: 20 – 48 V @ 48 – 62 Hz					
DC: 90 – 300 V; AC: 70 – 265 V @ 48 – 62 Hz					
Analogue Outputs					
0 – 1 mA analog outputs					
4 – 20 mA analog outputs					
Enhancements					
Enhanced display, larger LCD, improved keypad					
Enhanced display, larger LCD, improved keypad plus					
10BaseT Ethernet Port					
Environmental Protection					
H Harsh (Chemical) Environment Conformal Coating					

Accessories for the 489

489 Generator Protection Learning CD	TRCD-SR489-C-S-1
Multilink Ethernet Switch	ML1600-HI-A1-A1
Multinet™	Multinet-FE
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring	VP-1

Visit www.GEMultilin.com/489 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 489 online
- View the 489 brochure



Relays and Meters

Protection and Control

G650 Generator Protection System

Protection, control and monitoring for generator interconnection

Section 22

Key Benefits

- Complete distributed generator interconnection protection with two protection options, Basic Protection and Enhanced Protection, to fit your generator protection requirements.
- Preconfigured with Logic for standard Tripping and Closing operation.
- Reduce installation space requirements with a compact design incorporating protection, control, programmable pushbuttons, programmable LEDs, and communication interfaces
- Reduced system event analyzing time and cost through integrated Sequence of Event reports, Oscillography recording, and Trending files.
- Flexible and cost effective control for complex systems through the use of IEC61131 compatible programmable logic to customize the relay's operation
- Minimized communication down time through reliable redundant Ethernet Communication ports

Applications

- Protection of small to medium sized Induction or Synchronous Generators
- Stand-alone or component in automated substation control system
- Distributed generation and interconnection protection, management, and control where programmable logic is a requirement to interact with prime mover control system

Features

Basic Protection Option

- Phase, Neutral, Ground and Negative Sequence TOC and IOC
- Neutral and Ground Directional Overcurrent
- Voltage Restraint Overcurrent
- Phase Under and Overvoltage, Neutral and Ground Overvoltage
- Directional Power
- Under and Overfrequency, and Frequency Rate of Change
- Generator Thermal Model
- Generator Current unbalance
- Loss of Excitation
- Inadvertent Generator Energization

Enhanced Protection Option (Includes all Basic functions)

- Sensitive Ground Overcurrent
- Volts/Hz
- Power Factor limiting
- Vector surge loss of mains detection
- Breaker Failure
- VT Fuse failure
- Restricted Ground Fault



Features (continued)

Monitoring and Metering

- Current, voltage, power, power factor, frequency metering, demand
- Breaker condition monitoring including breaker arcing current (I2t) trip counters, and trip circuit monitoring
- Event Recorder - 479 time tagged events, with 1ms time resolution
- High resolution oscillography and Data Logger, with programmable sampling rate
- Fault locator, record of last 10 faults

Communications

- Standard serial interface with RS232 - up to 115,200 bps
- Optional second rear RS485 or serial fiber plastic or glass fiber optic port
- Ethernet Ports - 10/100 Base TX, 100 Base FX with ST connectors, options for redundancy available
- Multiple protocols - ModBus® RTU and over TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104, Http, and tftp.

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the G650 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

G650 Generator Protection System

Protection, control and monitoring for generator interconnection

Section 22

Ordering

To order select the basic model and the desired features from the Selection Guide below:

G650	*	*	*	F	*	G	*	*	Description
B									Display and Functionality Options
M									Basic Display and Basic Protection Functionality.
N									Graphical Display with Standard Symbols and Basic Protection Functionality.
E									Graphical Display with IEC Symbols and Basic Protection Functionality.
C									Basic Display and Enhanced Protection Functionality.
D									Graphical Display with Standard Symbols and Enhanced Protection Functionality.
									Graphical Display with IEC Symbols and Enhanced Protection Functionality.
									Rear Serial Communications Board 1
									None
									Redundant RS485
									Redundant plastic F.O.
									Redundant glass F.O.
									Redundant RS485 + remote fiber CAN bus I/O
									Redundant plastic F.O. + remote fiber CAN bus I/O
									Redundant glass F.O. + remote fiber CAN bus I/O
									Remote cable CAN bus I/O
									RS485 + Remote cable CAN bus I/O
									Rear Ethernet Communications board 2
									10/100 BaseT
									10/100 BaseT + 10/100 Base FX
									10/100 BaseT + redundant 10/100 Base FX
									Redundant 10/100 Base TX
									I/O board 1
								1	16 digital inputs + 8 outputs
								2	8 digital inputs, 4 circuits for circuit supervision, 6 Outputs + 2 outputs with circuits for trip current supervision (latching)
								4	32 Digital Inputs
								5	16 Digital Inputs + 8 Analog Inputs
									I/O board 2
								0	None
								1	16 Digital Inputs + 8 Outputs
								4	32 Digital Inputs
								5	16 Digital Inputs + 8 Analog Inputs
									Auxiliary Voltage
								LO	24-48 Vdc (range 19.2 - 57.6)
								HI	110-250 Vdc (range 88-300)
									120-230 Vac (range 88-264)
								LOR	Redundant LO
								HIR	Redundant HI
									ENVIRONMENTAL PROTECTION
								-	Without Harsh (Chemical) Environment
									Conformal Coating
								H	Harsh (Chemical) Environment Conformal Coating

Accessories for the G650

Multilink Ethernet Switch	ML1600-HI-A2-A2
Multinet™	Multinet-FE
Viewpoint Monitoring	VP-1

Visit www.GEMultilin.com/G650 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a G650 online
- View the G650 brochure



Relays and Meters

Protection and Control

W650 Wind Generator Protection System

Advanced wind turbine protection and control system

Section 22

Key Benefits

- Complete wind generator protection, control, metering and monitoring in a single device
- High accuracy metering for enhanced power control (real and reactive) even at low loads and harmonics presence
- Direct connection to generators up to 690 VAC eliminating the need of VTs.
- Maximum EMC and environmental performance per IEC/ ANSI standards enabling the use wind turbines environment including off-shore wind farms
- Reduced system event analyzing time and cost through integrated Sequence of Event reports, Oscillography recording, and Trending files.
- Flexible and cost effective control for complex systems through the use of IEC 61131 compatible programmable logic to customize the relay's operation
- Reduced communications downtime through the use of reliable redundant fiber optic Ethernet communications ports

Applications

- Protection of single wind turbine generators
- Transfer trip application for wind farm controls

Features

Protection and Control

- Phase, neutral, ground and sensitive ground overcurrent
- Negative sequence overcurrent
- Directional overcurrent
- Phase overvoltage
- Phase undervoltage
- Neutral overvoltage
- Voltage unbalance
- Breaker failure
- VT Fuse failure
- Generator Overload
- Underpower and reverse power
- Overfrequency and Underfrequency

Communications

- 100Mbit Fiber Optic Ethernet
- RS485, RS232, and Canbus serial interfaces
- Multiple Protocols - IEC61850, DNP 3.0 Level 2, Modbus RTU, Modbus TCP/IP, IEC60870-5-104, CANopen

Monitoring and Metering

- Metering - current, voltage, power, power factor, frequency, energy, demand
- Oscillography - analog and digital parameters at 64 samples/cycle
- Event Recorder - 128 time tagged events
- Data Logger - 16 channels with sampling rate up to 1 sample /second
- Fault Locator - 10 configurable Fault Reports



Features (continued)

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- Ease to use real time monitoring, control, and data archiving software available
- EnerVista™ Integrator providing easy integration of data in the W650 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

W650 Wind Generator Protection System

Advanced wind turbine protection and control system

Section 22

Ordering

To order select the basic model and the desired features from the Selection Guide below:

W650	*	*	*	F	*	G	*	*	*	*
B										
M										
	F									Basic display (4 x 20 characters)
	A									Graphic display (240 x 128 pixels)
	P									Rear serial communications board 1
	G									None
	X									Redundant RS485
	Y									Redundant plastic fiber optic
	Z									Redundant glass fiber optic
	C									Redundant RS485 + fiber CAN port (CANopen)
	M									Redundant plastic fiber optic + fiber CAN port (CANopen)
										Redundant glass fiber optic + fiber CAN port (CANopen)
										Cable CAN port (CANopen)
										RS485 + cable CAN port (CANopen)
										Rear ethernet communications board 2
										10/100 Base TX
										10/100 Base TX + 100 Base FX
										10/100 Base TX + Redundant 100 Base FX
										Redundant 10/100 Base TX
										I/O Board 1 in Slot F
										16 Digital Inputs + 8 Outputs
										8 Digital Inputs + 8 Outputs + 2 Trip / Close circuit supervision circuits
										32 Digital Inputs
										16 Digital Inputs + 8 Analog Inputs
										I/O Board in Slot G
										None
										16 Inputs + 8 Outputs
										32 Digital Inputs (See Note 1)
										16 Digital Inputs + 8 Analog Inputs (See Note 1)
										Auxiliary Voltage
										24-48 Vdc (range 19.2 - 57.6)
										110-250 Vdc (range 88 - 300)
										120-230 Vac (range 96 - 250)
										Redundant LO
										Redundant HI
										Protocol
										without IEC 61850
										IEC61850
										Environmental Protection
										Without Harsh (Chemical) Environment Conformal Coating
										Harsh (Chemical) Environment Conformal Coating

Note 1: The number selected for option G must be equal or higher than the number selected for option F.

Accessories for the W650

Multilink Ethernet Switch	ML1600-HI-A2-A2
Multinet™	Multinet-FE
Viewpoint Monitoring	VP-1

Visit www.GEMultilin.com/W650 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a W650 online
- View the W650 brochure



Relays and Meters

Protection and Control

MIG II Generator Protection System

Three-phase and ground protection for small generators

Section 22

Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Follow technology evolution - Flash memory for product field upgrade
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista™ compatible
- Isolated RS232 port



Applications

- Small generators and motors
- Component for bigger generator packages
- Standby/critical power protection main unit
- Small motor protection
- Transformer protection

Features

Protection and Control

- Phase, ground TOC
- Phase, ground IOC
- Thermal image protection
- Circuit breaker control (open and close)
- Negative Sequence Element
- Restricted Ground Differential Element
- Undercurrent
- Maximum number of starts
- Locked rotor
- Configurable I/O
- Six outputs: trip, service, 4 auxiliary
- 4 pre-configured overcurrent curves (ANSI, IEC)

Features (continued)

Monitoring and Metering

- 24-event record
- Analog/digital oscillography
- Per phase current metering
- Monitoring of the last 5 trips information from the display

User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus® RTU protocol up to 19,200 bps
- EnerVista™ Software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices

Ordering

To order select the basic model and the desired features from the Selection Guide below:

MIG II	*	*	*	*	E	0	0	*	0	0	Description
P											Application
Q											Generator protection elements
											Motor protection elements
											Curves
											ANSI
											IEC
											PHASE CT
											CT In = 5 A (0.5 - 12 A)
											CT In = 1 A (0.1 - 2.4 A)
											GROUND CT
											CT In = 5 A (0.5 - 12 A)
											CT In = 1 A (0.1 - 2.4 A)
											CT In = 1 A (0.005 - 0.12 A) *
											POWER SUPPLY
											24 - 48 Vdc (19.2 - 57.6 Vdc)
											110 - 250 Vdc (88 - 300 Vdc)
											110 - 230 Vac (88 - 264 Vac)

Visit www.GEMultilin.com/MIGII to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIG II online
- View the MIG II brochure



MIW II Directional Power Protection System

Numerical reverse, forward and low forward directional power and loss of field protection relay

Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analogy/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Flash memory for field upgrades
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista™ compatible
- Isolated RS232 port

Applications

- Controlling power flow in AC generator applications

Features

Protection and Control

- Three power elements for MIW II 1000 and four power elements for MIW II 2000 (32_x)
- Loss of field/excitation (40)
- Fuse failure (60)
- Configurable I/O
- 6 outputs, 4 configurable, plus trip and alarm

Monitoring and Metering

- Metering values for Ia, voltage values, P, Q, S, V₁, V₂ and angle.
- 24-event record
- Analog/digital oscillography - 24 cycles at 8 samples per cycle
- Information displayed on last 5 relay trips

User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus RTU protocol up to 19,200 bps
- EnerVista™ software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices



Visit www.GEMultilin.com/MIWII to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIW II online
- View the MIW II brochure

Ordering

MIW II*	0	0	0	E	0	0	*	0	0	DESCRIPTION
1										Protection Elements: 3 x Directional Power 1 x Loss of field, 1 x Fuse Failure 4 x Directional Power
2										Power Supply 24-48 VDC (Range: 19~58 VDC) 110-250 VDC (Range: 88~300 VDC) 110-230 VAC (Range: 88~264 VAC)
							LO HI			



Selector Guide

page 22-37

Complete transformer protection comparison

A reference table highlighting the feature set for each protection system

T60

page 22-38

Comprehensive multi-winding transformer protection system

The T60 Transformer Protection System is designed for various power transformer applications, including auto-transformers, generator step up transformers, split-phase, angle regulating transformers and reactors. Uses multiple current and voltage inputs to provide primary protection and back-up protection of transformers, including differential, ground differential, phase, neutral, and ground overcurrent, under- and over-voltage, under- and over-frequency, over-fluxing, and breaker failure protection. Also provides protection of transformer based on winding temperature and loss-of-life calculations.



T35

page 22-40

Cost effective protection for transformers with up to 6 restraints

The T35 Transformer Protection System is designed to provide basic transformer protection functions for variety of transformer applications. Uses multiple current inputs to provide primary protection and backup protection of transformers, including differential, phase and ground overcurrent, protection. The relay can be configured to accept up to 6 sets of current inputs to provide proper differential restraint for applications with three winding transformers with windings configured in dual breaker arrangements.



745

page 22-42

Draw-out transformer protection system

The 745 Transformer Protection System is a full featured transformer protection relay, suitable for application on small, medium, and large power transformers. The 745 can be applied on two-winding and three-winding transformers. Uses multiple current and voltage inputs to provide primary protection and back-up protection of transformers, including differential, ground differential phase, neutral, and ground overcurrent, over-fluxing, and on-load tap changer. The 745 also has specific features for industrial environments, including a drawout case to limit downtime during maintenance and conformal coating for harsh environments. 745 also includes analog inputs and outputs, while incorporating advanced features such as transformer loss of life calculations.



345

page 22-44

Intuitive protection and advanced communications for power transformers

Microprocessor-based system for primary and backup protection of small and medium sized, 2-winding, distribution transformers. The Multilin 345 offers advanced algorithms for magnitude and phase compensation. The 345 includes advanced communications supporting simultaneous communications, enhanced draw-out construction and enhanced diagnostics for asset monitoring and simplified setup & configuration tools to reduce commissioning time.



Features	Device	745	T35	T60
Protection & Control				
Transformer Differential	87T	•	•	•
Maximum Number of Windings		3	6	5
Harmonic Restraint		•	•	•
Internal Winding Phase Shift Compensation		•	•	•
Dynamic CT Ratio-Matching		•	•	•
CT Mismatch Range		16/1	32/1	32/1
Restricted Ground Fault	87RGF	•	•	•
Over-Fluxing (Voltz Per Hertz)	24	•	•	•
Phase Undervoltage	27P	•	•	•
IOC, Ground/Neutral/Phase	50G/N/P	G/N/P	•	G/N/P
TOC, Ground/Neutral/Phase	51G/N/P	G/N/P	G/P	G/N/P
Custom programmable overcurrent curves		•	•	•
Overvoltage, Neutral/Phase/Auxiliary	59N/P/X	•	•	N/P/X
Overvoltage, Symmetrical Component	59N	•	•	•
Current Directional, Neutral/Phase	67 N/P	•	•	P/N
Voltage Transformer Fuse Failure	VTFF	•	•	•
Under/Overfrequency	81U/O	•	•	•
Synchrocheck	25	•	•	•
Transformer Overload	49	•	•	•
Lockout	86	•	•	•
Automation				
Settings Groups		4	6	6
Contact Inputs (Up to)		16	96	96
Contact Outputs (Up to)		8	64	64
Non-volatile latches		•	•	•
Programmable Logic		•	•	•
FlexElements™		•	•	•
Virtual Inputs/Outputs		16/16	64/96	64/96
Direct Inputs/Outputs			32/32	32/32
Programmable Pushbuttons			12	12
Trip/Close Coil Supervision		Trip	Trip/Close	Trip/Close
User-Programmable LEDs			48	48
User-Programmable Self Test			•	•
Selector Switch			•	•
Digital Counters			•	•
Digital Elements			•	•
Analog Inputs/Outputs (Up to)		1	24/12	24/12
RTD Inputs (Up to)		1	24	24
Monitoring & Metering				
Power Factor		•	•	•
Current – RMS		•	•	•
Current – Phasor		•	•	•
Current – Demand		•	•	•
Current - Unbalance		•	•	•
Voltage		•	•	•
Power - Apparent, Real, Reactive		•	•	•
MW, MVA, Mvar Demand		•	•	•
Breaker Arc Current		•	•	•
Energy		•	•	•
Frequency		•	•	•
Temperature		•	•	•
Current Harmonics (Up to)		21	•	25
Loss of Life Calculations		•	•	•
Fault Report		•	•	•
User Programmable Trip Reports		•	•	•
Event Recorder - Number of Events		40	1024	1024
Oscillography - Sampling Rate		12	64	64
Trip Counters		•	•	•
Data Logger		•	•	•
Simulation Mode		•	•	•
Communications				
RS232 Port		•	•	•
RS485 Port		•	•	•
RS422, G.703, C37.94		•	•	•
Ethernet		•	•	•
Fiber (800nm, 1300nm, 1550nm)		•	•	•
Protocols				
ModBus (RTU & TCP/IP)		•	•	•
DNP3		•	•	•
EGD Protocol		•	•	•
IEC61850		•	•	•
IEC 60870-5-104		•	•	•
Simple Network Time Protocol		•	•	•
TCP/IP		•	•	•
HTTP		•	•	•
IRIG-B Input		•	•	•
Process Bus (IEC 61850-9-2)		•	•	•



Relays and Meters

Protection and Control

T60 Transformer Protection System

Full-Featured, Multiple-Winding Transformer Protection

Section 22

Key Benefits

- Secure high-speed protection for transformers, compliant with IEEE® C37.91
- Improved security for transformer energization and inrush provided through a superior adaptive 2nd harmonic restraint algorithm
- Sensitive ground fault protection provides low-impedance differential protection down to 5% of the winding to limit transformer damage
- Phasor Measurement Unit (synchrophasor) according to IEEE C37.118 (2011) and IEC® 61850-90-5 support
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Advanced fault and disturbance recording, including internal relay operating signals, eliminating the need for redundant recording devices
- Integrated transformer thermal monitoring for asset management and maintenance optimization
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Transformer asset monitoring using hottest spot, loss-of-life and aging factor
- Applicable for transformers with up to six windings in a ring bus or breaker-and-a-half configuration
- Reliable and secure protection for three-phase transformers, autotransformers, reactors, split phase and phase angle regulating transformers
- Stand-alone or component in automated substation control system

Features

Protection and Control

- Dual-slope, dual-breakpoint differential restraint characteristic, restrained and unrestrained differential
- 2nd harmonic inrush and overexcitation inhibit
- Transformer overexcitation and thermal overload protection
- Restricted ground fault
- Loss-of-life, aging factor, hottest spot
- Five-zone backup distance protection with power swing detection and load encroachment function
- Synchrocheck



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip (DTT) applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency, temperature, transformer monitoring
- P & M class synchrophasors of voltage, current and sequence components: reporting rate 1 to 120 frames/s
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to T60 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the T60 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

T60 Transformer Protection System

Full-Featured, Multiple-Winding Transformer Protection

Section 22

Ordering

T60 - * 00 - H * * - F ** - H ** - M ** - P ** - U ** - W/X **										For Full Sized Horizontal Mount
Base Unit	T60	E								Base Unit
CPU		G								RS485 + RS485 (IEC 61850 option not available)
		H								RS485 + Multimode ST 10BaseF
		J								RS485 + Multimode ST Redundant 10BaseF
		K								RS485 + Multimode ST 100BaseFX
		N								RS485 + Multimode ST Redundant 100BaseFX
		T								RS485 + 10/100 BaseT
		U								RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
		V								RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see notes 1 & 3 below)			00							RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
			01							No Software Options
			03							Ethernet Global Data (EGD)
			04							IEC 61850
			06							Ethernet Global Data (EGD) + IEC 61850
			07							PMU
			10							IEC 61850 + PMU
			11							Synchrocheck
			20							Synchrocheck + IEC 61850
			21							5 windings (No Breaker Failure)
			22							5 windings (No Breaker Failure) + EGD
			23							5 windings (No Breaker Failure) + IEC 61850
			33							5 windings (No Breaker Failure) + EGD + IEC 61850
			34							PMU + Synchrocheck
			A0							PMU + IEC 61850 + Synchrocheck
			B0							CyberSentry UR Lvl 1. Req UR FW 7.xx or higher
			C0							IEEE 1588. Req UR FW 7.xx or higher
			D0							PRP
Mount / Coating				H						IEEE 1588 + CyberSentry. Req UR FW 7.xx or higher
				A						Horizontal (19" rack) - Standard
				V						Horizontal (19" rack) - Harsh Chemical Environment Option
				B						Vertical (3/4 size) - Standard
User Interface					K					Vertical (3/4 size) - Harsh Chemical Environment Option
					L					Enhanced English Front Panel
					M					Enhanced English Front Panel with User-Programmable Pushbuttons
					N					Enhanced French Front Panel
					O					Enhanced French Front Panel with User-Programmable Pushbuttons
					T					Enhanced Russian Front Panel
					U					Enhanced Russian Front Panel with User-Programmable Pushbuttons
					V					Enhanced Chinese Front Panel
					F					Enhanced Chinese Front Panel with User-Programmable Pushbuttons
					W					Vertical Front Panel with English display
					Y					Enhanced Turkish Front Panel
Power Supply (see note 2 below)					H				RH	Enhanced Turkish Front Panel with User-Programmable Pushbuttons
					L					125 / 250 V AC/DC
CT/VT DSP						8L		8L		125/250 V AC/DC with redundant 125/250 V AC/DC
						8M		8M		24 - 48 V (DC only)
						8N		8N		Standard 4CT/4VT w/ enhanced diagnostics
						8R		8R		Sensitive Ground 4CT/4VT w/ enhanced diagnostics
IEC 61850 Process Bus							81			Standard 8CT w/ enhanced diagnostics
Digital I/O										Sensitive Ground 8CT w/ enhanced diagnostics
										8 Port IEC 61850 Process Bus Module
										No Module
										4 Solid State (No Monitoring) MOSFET Outputs
										4 Solid State (Current w/opt Voltage) MOSFET Outputs
										16 Digital Inputs with Auto-Burnish
										14 Form-A (No Monitoring) Latchable Outputs
										8 Form-A (No Monitoring) Outputs
										8 Form-C Outputs
										16 Digital Inputs
										4 Form-C Outputs, 8 Digital Inputs
										8 Fast Form-C Outputs
										4 Form-C & 4 Fast Form-C Outputs
										2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
										4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
										6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
										2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
										2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
										4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
										6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
										2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
Transducer I/O						5A	5A	5A	5A	4 dcmA Inputs, 4 dcmA Outputs
						5C	5C	5C	5C	8 RTD Inputs
						5E	5E	5E	5E	4 dcmA Inputs, 4 RTD Inputs
						5F	5F	5F	5F	8 dcmA Inputs
Inter-Relay Communications										820 nm, multimode, LED, 1 Channel
										1300 nm, multimode, LED, 1 Channel
										1300 nm, singlemode, ELED, 1 Channel
										820 nm, multimode, LED, 2 Channels
										1300 nm, multimode, LED, 2 Channels
										1300 nm, singlemode, ELED, 2 Channels
										G.703, 2 Channels
										RS422, 2 Channels
										IEEE C37.94, 820 nm, multimode, LED, 2 Channel
										C37.94SM, 1300nm singlemode, ELED, 2 Channel singlemode

Ordering Notes:

- To view all the options available for T60, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=T60>
- Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis.
- All "5 windings (No breaker Failure)" options become "6 windings w/breaker failure" when FW v7xx is chosen.

Accessories for the T60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

T35 Transformer Protection System

Section 22

Cost-Effective Differential Protection for Transformers with Up to 6 Sets of CTs

Key Benefits

- Secure high-speed transformer differential protection with advanced features in a cost-effective package
- Improved security for transformer energization and inrush provided through a superior adaptive 2nd harmonic restraint algorithm
- Application flexibility for transformers with up to 6 sets of CTs, with independent magnitude/phase angle compensation and grounding settings
- Advanced automation capabilities for providing customized protection and control solutions
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 micro-second time synchronization via LAN with IEEE® 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Increase network availability by reducing failover time to zero through IEC® 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Advanced fault and disturbance recording, including internal relay operating signals, eliminating the need for redundant recording devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Combined protection for transformer and small bus zone, including breaker-and-a-half and ring bus diameters
- Stand-alone or component in automated substation control system
- Primary and backup protection of power transformers, autotransformers, reactors, split-phase and angle regulating transformers
- Advanced data logging for asset management and maintenance optimization

Features

Protection and Control

- Percent restrained and unrestrained differential protection
- 2nd harmonic inrush inhibit and overexcitation inhibit
- Thermal overload and time overcurrent elements for backup protection
- Transducer I/Os (RTD & dcma)
- FlexElements
- FlexCurves



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip (DTT) applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency, temperature
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to T35 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the T35 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

T35 Transformer Protection System

Section 22

Cost-Effective Differential Protection for Transformers with Up to 6 Sets of CTs

Ordering

	T35	-	*	**	-	H	*	-	F**	-	H**	-	M**	-	P**	-	U**	-	W**	For full sized horizontal mount
Base Unit CPU	T35	E	G	H	J	K	N	T	U	V										Base Unit RS485 & RS485 (IEC 61850 option not available) RS485 + 10BaseF RS485 + Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 100BaseT RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (See note 1 below)		00	01	03	04	A0	B0	C0	D0											No Software Options Ethernet Global Data (EGD) IEC 61850 Ethernet Global Data (EGD) + IEC 61850 CyberSentry UR Lvl 1. Req UR FW 7.xx or higher IEEE 1588. Req UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry. Req UR FW 7.xx or higher
Mount						H	A	V	B											Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface						K	L	M	N	Q	T	U	V	F	W	Y				Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)						H	H	L												125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC power supply 24 - 48 V (DC only)
CT/VT DSP									8L	8M	8N	8R								Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 2CT/6VT w/ enhanced diagnostics
IEC 61850 Process Bus Digital I/O									81	XX	XX	XX	XX	XX						8 Port IEC 61850 Process Bus Module No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
Transducer I/O									5A	5A	5A	5A	5A	5A						4 dcmA inputs, 4 dcmA outputs 8 RTD Inputs 4 dcmA Inputs, 4 RTD Inputs 8 dcmA Inputs
Inter-Relay Communications									5F	5F	5F	5F	5F	5F						7A 820 nm, multimode, LED, 1 Channel 7B 1300 nm, multimode, LED, 1 Channel 7C 1300 nm, singlemode, ELED, 1 Channel 7H 820 nm, multimode, LED, 2 Channels 7I 1300 nm, multimode, LED, 2 Channels 7J 1300 nm, singlemode, ELED, 2 Channels 7S G.703, 2 Channels 7W RS422, 2 Channels 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel

Notes: 1. To view all the options available for T35, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=T35>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis.

Visit www.GEMultilin.com/T35 to:

- View guideform specifications
- Download the instruction manual
- Review application notes and support documents
- Buy a T35 online
- View the UR family brochure

Accessories for the T35

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

745 Transformer Protection System

High-speed, draw-out transformer protection and management

Section 22

Key Benefits

- Easy to use Transformer Protection System supported by industry leading suite of software tools to optimize transformer performance and to extend life expectancy
- Improved security for transformer energization using superior Adaptive 2nd Harmonic Restraint algorithm
- Accurate built-in metering functions - Eliminates auxiliary metering devices and reduces cost
- Advanced automation capabilities using FlexLogic to provide customized protection and control solutions
- Fast, flexible and reliable communications - Embedded 10BaseT Ethernet capability provides faster data transfer for improved system performance
- Minimize replacement time - Draw-out construction ideal in industrial environments
- Reduce troubleshooting time and maintenance costs - IRIG-B time synchronization, event reports, waveform capture, data logger
- Simplified testing - Built in simulation features for setpoint verification including waveform playback for relay setting verification
- Cost effective access to information - Modbus and DNP 3.0 Level 2 protocols through embedded Ethernet, standard RS232, RS485 & RS422 serial ports.
- Globally accepted - Member of the most renowned product family in the market.
- Extended life - Optional conformal coating for chemically corrosive and humid environments
- Fast and easy troubleshooting, improved maintenance procedures and increased device security - Security Audit Trail provides detailed traceability for system configuration changes

Applications

- Primary and back-up protection and management of small, medium and larger power transformers, autotransformers and reactors
- Transformer asset monitoring using Hottest Spot, Loss-of- Life and Aging Factor
- Stand-alone or component in automated substation control system

Features

Protection and Control

- Variable dual-slope percent differential protection
- Magnetizing inrush and overexcitation blocking
- Phase & ground overcurrent elements
- Adaptive time overcurrent using FlexCurves elements
- Underfrequency/Overfrequency Protection
- Frequency rate-of-change Detection
- Overexcitation (V/Hz) Protection
- Restricted Ground Fault Protection
- Transformer overload protection



Features (continued)

Communications

- Networking interfaces - 10Mbps Ethernet, RS232, RS485 and RS422 ports
- Ethernet port, 10Mbps
- Multiple protocols - ModBus® RTU, ModBus® RTU TCP/IP, DNP 3.0 Level 2

Monitoring and Metering

- Metering - current, voltage, sequence components per winding, power, energy, voltage
- THD and harmonics up to the 21st
- Event recording - 128 time tagged events
- Tap position up to 50 tap positions
- Ambient temperature /analog transducer input
- Analog transducer input
- Oscillography & Data Logger - 10 records up to 32 power cycles
- Simulation mode and playback capability.

EnerVista™ Software

- Sophisticated software for configuration and commissioning
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset
- EnerVista™ Integrator providing easy integration of data in the 745 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

745 Transformer Protection System

High-speed, draw-out transformer protection and management

Section 22

Ordering

745	*	*	*	*	*	*	*	*	*
745									
	W2								
	W3								
	P1								
	P5								
	P15								
	P51								
	P115								
	P151								
	P155								
	P511								
	P515								
	P551								
	G1								
	G5								
	G15								
	G51								
	LO								
	HI								
	A								
	L								
	R								
	E								
	T								
	H								

Base unit Transformer Protection System

Phase Current Input Rating

2 windings per phase

3 windings per phase

Phase Current Input Rating

1 A for all windings

5 A for all windings

1 A for winding 1, 5 A for winding 2

5 A for winding 1, 1 A for winding 2

1 A for winding 1, 1 A for winding 2, 5 A for winding 3

1 A for winding 1, 5 A for winding 2, 1 A for winding 3

1 A for winding 1, 5 A for winding 2, 5 A for winding 3

5 A for winding 1, 1 A for winding 2, 1 A for winding 3

5 A for winding 1, 1 A for winding 2, 5 A for winding 3

5 A for winding 1, 5 A for winding 2, 1 A for winding 3

Ground Current Input Rating

1 A for windings 1 and 2, 1 A for windings 2 and 3

5 A for windings 1 and 2, 5 A for windings 2 and 3

1 A for windings 1 and 2, 5 A for windings 2 and 3

5 A for windings 1 and 2, 1 A for windings 2 and 3

Power Supply Options

24 – 60 VDC, 20 – 48 VAC @ 48 – 62 Hz

90 – 300 VDC, 70 – 265 VAC @ 48 – 62 Hz

Enhancements

Analog input/outputs option

Loss of Life

Restricted ground fault option

Enhanced display, larger LCD, improved keypad

Enhanced display, larger LCD, improved keypad plus

10BaseT Ethernet Port

Environmental Protection

Harsh (Chemical) Environment Conformal Coating

Accessories

Dual mounting available with the 19-2 Panel

NOTE: For dimensions see SR Family brochure.

Accessories for the 745

745 Applications Learning CD	TRCD-SR745-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

Visit www.GEMultilin.com/745 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 745 online
- View the SR Family brochure



Relays and Meters

Protection & Control

345 Transformer Protection System

Section 22

Intuitive protection and advanced communications for power transformers

Key Benefits

- Proven and secure high-speed protection system for power transformers
- Integrated transformer thermal monitoring for asset management maintenance optimization
- Improved transformer energization inhibiting
- Ground current supervised sensitive ground fault protection for detection of ground faults down to 5% of the winding limiting the transformer damage
- Assignable CT inputs provide flexibility of usage through all timed and instantaneous over-current protections
- Powerful communication capabilities allowing seamless integration into most communication architectures
- Easy access to information via multiple communication networks including USB, Serial, Fiber or copper Ethernet
- Small footprint easy on new installations or retrofits
- Simplified transformer and protection setup right from the main menu Quick Setup feature. Fast and easy menu navigation

Applications

- Low and medium voltage two winding power transformers
- Reactors and autotransformers
- Applications requiring fast and secure communications
- Harsh environments requiring protection against corrosion and humidity

Features

Protection and Control

- Dual slope, dual breakpoint characteristic restrained differential
- Second harmonic inrush and fifth harmonic over-excitation inhibits
- Instantaneous differential
- Restricted Ground Fault
- Thermal model
- Neutral Timed and Instantaneous over-current
- Phase and Ground Timed and Instantaneous over-current
- Negative Sequence Timed over-current
- Breaker Failure
- Logic Elements



Features (continued)

Enervista™ Software

- Enervista™ Software- an industry-leading suite of software tools that simplifies every aspect of working with Multilin devices.

Metering & Monitoring

- Current Metering
- Event Recorder: 256 events with 1ms time stamping
- Oscillography with 32 samples per cycle and digital states
- IRIG-B clock synchronization
- Security audit trail

User Interface

- 4X20 character LCD display
- Control panel with 12 LED indicators
- Front USB and rear serial, Ethernet and Fiber ports
- Multiple Protocols:
 - IEC 61850
 - IEC 61850 GOOSE
 - MODBUS TCP/IP, MODBUS RTU,
 - DNP 3.0, IEC60870-5-104, IEC60870-5-103



Relays and Meters

Protection & Control

345 Transformer Protection System

Intuitive protection and advanced communications for power transformers

Section 22

Ordering

	345	E	**	**	**	E	*	N	N	**	D	*	Description
Base Unit	345												Base Unit
Language		E											English
Phase Currents			P1										1A three phase current inputs
			P5										5A three phase current inputs
345 Ground Currents*				G1									1A ground current input
				G5									5A ground current input
				S1									1A sensitive ground current input
				S5									5A sensitive ground current input
Power Supply					L								24 - 48 Vdc
					H								110 - 250 V dc/110 - 230 Vac
Faceplate						E							Standard faceplate (LCD, full menu, actual values and setpoints) with 10 Inputs, 7 Outputs (2 Form A, 5 Form C)
345 Current Protection							S						Standard configuration - 87T, 87T-50, 51P(1), 51G(1), 50P(1), 50G(1), 51N(1), 50N(1)
							E						Extended configuration - 87T, 87T-50, 51P(2), 51G(2), 50P(2), 50G(2), 51N(2), 50I(2), 50BF(1), RGF(1), 49P
							M						Advanced configuration - 87T, 87T-50, 51P(2), 51G(2), 50P(2), 50G(2), 50BF(2), 49P, 51N(2), 50N(2), 51_2 (2), RGF(2)
Communications									SN				Standard :Front USB, Rear RS485 : Modbus RTU, DNP3.0, IEC60870-5-103
									1E				Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104
									2E				Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE
									3E				Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850
Case Design											D		Draw-out design
Harsh Environment												N	None
												H	Harsh Environment Conformal Coating

Ordering Notes:

* 1) G1/G5 and S1/S5 must match corresponding P1/P5 - there cannot be 5A and 1A mixing

Accessories for the 345

Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850

Visit www.GEMultilin.com/345 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 345 online
- View the 3 Series Family brochure



Selector Guide

page 22-48

Complete transmission line protection product comparison

A reference table highlighting the feature set for each protection system

L90

page 22-50

Phase segregated line current differential protection

The L90 provides high-speed current differential protection suitable for transmission lines and cables of various voltage levels. The L90 supports dual breaker applications suitable for single and three-pole tripping applications. The L90 uses synchronized sampling at each relay to limit the impact of communications channel issues. The differential element employs an adaptive restraint to balance sensitivity for internal faults and security during external faults. The L90 supports inter-relay protection communications via direct fiber as well as different interfaces including RS422, G.703 and C37.94. The L90 also provides Synchrophasor measurement over Ethernet as per IEEE C37.118.



L60

page 22-52

Sub-cycle phase comparison protection

The L60 provides fast and secure sub-cycle phase comparison protection, for both two-terminal and three-terminal lines, lines with series compensation and for single-pole and three-pole tripping applications. The L60 can operate using existing Power Line Carrier or fiber optic communications, and compensates for channel asymmetry and charging currents. The L60 can provide complete support of dual-breaker line terminals by using multiple current inputs. Supports both dual and single phase comparison, and can be configured for tripping or blocking applications.



L30

page 22-54

Cost-effective current differential system for lines and cables

The L30 is a cost-effective line current differential protection relay intended for sub-transmission and medium voltage lines and cables providing reliable and secure operation even under the worst case power system conditions. The L30 provides secure high-speed fault detection and clearance suitable for three-pole tripping applications. The L30 supports inter-relay communications via direct fiber as well as standard RS422, G.703 and C37.94 telecommunication interfaces. The L30 also provides synchrophasor measurements over Ethernet per IEEE C37.118.



D90^{Plus}

page 22-56

Sub-cycle line distance protection & advanced automation controller

The D90^{Plus} is a sub-cycle line distance protection system and bay controller suitable for protecting transmission lines and cables including lines equipped with series compensation. The D90^{Plus} supports dual-breaker applications and can be used for single or three-pole tripping. The D90^{Plus} supports different teleprotection schemes, including DCB, DCU, POTT, Hybrid POTT, and PUTT. The D90^{Plus} also provides Synchrophasor measurement over Ethernet per IEEE C37.118. The automation controller, dedicated programmable logic separate from programmable logic for protection applications, color annunciator and HMI panels make D90^{Plus} a stand-alone substation controller.



D60

[page 22-58](#)

Transmission line protection with three/single pole tripping

The D60 is suitable for protecting transmission lines and cables including lines equipped with series compensation. The D60 supports dual-breaker applications and can be applied in single-pole or three-pole tripping applications. The D60 is applicable to different teleprotection schemes, including DCB, DCU, POTT, Hybrid POTT, and PUTT, and includes inter-relay protection communications via direct fiber as well as different interfaces including RS422, G.703 and C37.94. The D60 also provides Synchrophasor measurement over Ethernet per IEEE C37.118.



D30

[page 22-60](#)

Cost-effective, three pole, primary and backup distance protection

The D30 is a cost-effective distance protection system suitable for primary protection of sub-transmission lines and as a backup protection for HV, EHV lines, reactors and generators. The D30 provides three zones of phase and ground distance protection along with complete overcurrent and voltage protection functions intended for three-pole tripping applications. The D30 comes with versatile automation features using which custom pilot schemes can be built. The D30 also includes inter-relay protection communications via direct fiber as well as different interfaces including RS422, G.703 and C37.94.



Features	Device	D30
Applications		
Distance	21	•
Line Differential - Current Comparison	87L	
Line Differential - Phase Comparison	87PC	
Breaker-and-Half configurations		
Series Compensation		•
Three terminal lines		•
Lines with in-zone transformers		•
Synchrophasors		
Protection & Control		
Typical Operating Time (cycles)		<2
Mho Phase & Ground Distance (No. of Zones)	21P/G	3
Quad Phase & Ground Distance (No. of Zones)	21P/G	3
IOC, Ground/Neutral/Phase/Negative Sequence	50G/N/P/ 2	G/N/P/ 2
TOC, Ground/Neutral/Phase/Negative Sequence	51G/N/P/ 2	G/N/P/ 2
Directional overcurrent, Neutral/Phase/Neg. Seq.	67G/N/P/ 2	N/P/ 2
Wattmetric Ground Directional		
Overvoltage Phase/Auxiliary/Neutral	59P/X/N	P/X/N
Undervoltage Phase/Auxiliary	27P/X	P/X
Negative Sequence Overvoltage	59 2	•
Under/Over frequency	81U/O	
Out-of-Step Blocking/Tripping	68B	•
Switch on to Fault (Line Pickup)	SOTF	•
Voltage Transformer Fuse Failure	VTFF	•
Current Transformer Supervision		
Open Pole Detector		
Load Encroachment Logic		•
Breaker Failure	50BF	
Breaker Flashover		
Lockout Functionality	86	•
Synchronism Check or Synchronizing	25	•
AC Reclosing (No. of Shots)	79	4
Trip Modes: Three-Pole/Single-Pole		3
Pilot Protection Logic		
Fault Location		•
Automation		
Programmable Protection Logic (no of lines)		512
Programmable Automation Logic (no of lines)		
FlexElements™		•
User Programmable Self-Test Contact		•
Settings Groups		6
Non-volatile latches (up to)		16
Contact Inputs Programmable - (up to)		80
Contact Outputs Programmable - (up to)		64
Virtual Inputs - (up to)		32
Virtual Outputs - (up to)		64
Direct Inputs/Outputs		•
Breaker Control (up to)		2
User-Programmable LEDs (up to)		48
User - Programmable Annunciator Alarms (up to)		
User-Programmable Push Buttons (up to)		12
User-Programmable Self Test		•
User Definable Displays		•
Large HMI		
Timers		•
Selector Switch		•
Digital Counters		•
Digital Elements		•
IRIG-B Input		•
Analog Inputs/Outputs (up to)		24
RTD Inputs (up to)		24
Monitoring & Metering		
Current, voltage		•
Symmetrical Components		•
Power - Apparent, Real, Reactive		•
Energy		
Power Factor		•
Frequency		•
Fault Location		•
Event Recorder - Number of Events		1024
Oscillography - Sampling Rate		64/5
Disturbance Recorder - Sampling Rate/Duration in seconds		
Breaker Arcing Current		•
Trip/Close Coil Supervision		•
Data Logger		
Communications Interfaces		
RS232 Port		•
USB Port		
RS485 Port		•
Ethernet Port (Fiber and Copper, up to)		1
Direct Fiber Communications (800nm, 1330nm, 1550nm)		•
Communication Interface (RS422, G.703, C37.94)		•
Protocols		
ModBus RTU and TCP/IP		•
DNP3		•
IEC60870-5-104		•
UCA2/MMS		•
IEC61850		•
Simple Network Time Protocol (SNTP)		•
HTTP		•
TFTP		•
Process Bus (IEC 61850-9-2)		•

* For the most current comparison list, see www.GEMultilin.com/selector/transmission.pdf



Section 22



Relays and Meters

Protection and Control

L90 Line Current Differential System

Section 22

Line Protection System with Segregated Line Current Differential and Complete Distance Protection

Key Benefits

- Phase segregated differential protection ensures secure high-speed single-pole tripping
- High-speed cost-effective five zones quad or mho, phase and ground distance protection with multiple standard pilot schemes support
- Reliable and secure protection on lines equipped with series compensation
- In-zone power transformer enables savings on CTs and protection device requirements
- Increased sensitivity through dynamic charging current compensation and communication channel asymmetry compensation

Applications

- Overhead lines including series compensated lines and underground cables of different voltage levels
- Circuits with tapped transformer feeders
- Suitable for three-terminal line configurations, with channel redundancy and direct transfer tripping (DTT)

Features

Protection and Control

- Phase segregated line current differential with adaptive restraint, ground differential, in-zone transformer and stub bus protection
- Thermal protection, under/over frequency, broken conductor
- Phase distance (five zones) with independent compensation settings for in-zone power transformers
- Ground distance (five zones) with independent self and mutual zero-sequence compensation, reverse power
- Line pickup, reverse power, out-of-step tripping and power swing blocking
- Thermal overload, phase, neutral and negative sequence directional overcurrent and broken conductor
- Over, under and rate of change of frequency, synchronism check for dual breaker applications

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between L90s for DTT applications



Features (continued)

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Multi-ended fault location consistently providing 2% accuracy
- Real-time monitoring of remote, local and differential per-phase currents
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- P & M class synchrophasors of voltage, current and sequence components: reporting rate 1 to 120 frames/sec

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset that ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the L90 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

L90 Line Differential System

Section 22

Line Protection System with Segregated Line Current Differential and Complete Distance Protection

Ordering

	L90	-	* 00	-	H	*	-	F **	-	H **	-	L **	-	N **	-	S **	-	U **	-	W/X	**	For Horizontal Mount
Base Unit CPU	L90		E G H J K N T U V																			Base Unit RS485 + RS485 (IEC 61850 option not available) RS485 + Multimode ST 10BaseF RS485 + Multimode ST Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 BaseT RS485 + three Multimode SFP LC 100BaseFX. Requires FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Requires FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Requires FW v7xx or higher No Software Options Breaker and Half software IEC 61850 Breaker and Half + IEC 61850 Phasor Measurement Unit (PMU) IEC 61850 + Phasor Measurement Unit (PMU) Breaker & Half + Phasor Measurement Unit (PMU) Breaker & Half + IEC 61850 + Phasor Measurement Unit (PMU) In-zone TX protection In-zone TX protection + IEC 61850 In-zone TX protection + PMU In-zone TX protection + IEC 61850 + PMU CyberSentry UR Lvl 1. Requires UR FW 7.xx or higher IEEE 1588. Requires UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry UR Lvl 1. Requires UR FW 7.xx or higher
Software Options (see note 2)			00 02 03 05 06 07 08 09 24 25 26 27 A0 B0 C0 D0																			
Mount / Coating					H A V B																	Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface						K L M N O T U V F W Y																Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 3)																						RH 125/250 V AC/DC 24 - 48 V (DC only)
CT/VT DSP								8L				8L										Standard 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics
IEC 61850 Process Bus								8N				81										8 Port IEC 61850 Process Bus Module
Digital I/O												XX	XX	XX	XX	XX	XX	XX	XX	XX	XX	No Module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs 4 dcmA Inputs, 4 dcmA Outputs 8 dcmA Inputs
Transducer I/O												5A	5A	5A	5A	5A	5A	5A	5A	5A	5A	
Inter-Relay Communications												5F	5F	5F	5F	5F	5F	5F	5F	5F	5F	7A 820 nm, multimode, LED, 1 Channel 7B 1300 nm, multimode, LED, 1 Channel 7C 1300 nm, singlemode, ELED, 1 Channel 7H 820 nm, multimode, LED, 2 Channels 7I 1300 nm, multimode, LED, 2 Channels 7J 1300 nm, singlemode, ELED, 2 Channels 7S G.703, 2 Channels 7W RS422, 2 Channels 7V RS422, 2 Channels, Dual Clock 73 1550 nm, singlemode, LASER, 2 Channel 76 IEEE C37.94, 820 nm, multimode, LED, 1 Channel 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel 2B C37.94SM, 1300nm singlemode, ELED, 2 Channel singlemode

Ordering Notes:

- 1 - For vertical mounting order codes, please visit our online store
- 2 - To view all the options available for L90, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=L90>
- 3 - Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis.

Accessories for the L90

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

L60 Line Phase Comparison System

Sub-Cycle Phase Comparison and Distance Protection

Section 22

Key Benefits

- Extremely fast and secure phase comparison protection with a typical tripping time of $\frac{3}{4}$ power cycle
- End-to-end communication over power line carrier provides cost-effective solution
- Advanced algorithms for channel noise immunity, accurate per-channel signal asymmetry, charging current compensation and channel delay compensation
- Three-zone high-speed backup phase and ground distance function
- Application flexibility: multiple I/O options, programmable logic (FlexLogic™), modularity, customizable to specific requirements
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE® 1588 support
- Embedded IEC® 61850 protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Advanced fault and disturbance recording, including internal relay operating signals, eliminating the need for external recording devices

Applications

- Short and long overhead lines and cables of different voltage levels
- Suitable for two and three-terminal lines
- Circuits with tapped transformer feeders
- Implicit direct transfer trip (DTT) for breaker failure applications

Features

Protection and Control

- Single or dual-phase comparison with permissive and blocking schemes for two and three-terminal applications
- Multiple instantaneous and timed directional overcurrent elements
- 3-zone phase and ground distance elements
- Thermal overload, phase, ground, neutral and negative sequence overcurrent elements
- Overvoltage and undervoltage
- Single-pole, dual-breaker autoreclose with synchronism check
- CT failure, VT fuse failure
- Wattmetric zero-sequence directional function

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, IEEE C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, PRP
- Direct I/O: secure high-speed exchange of data between URs for DTT and pilot-aided distance schemes
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports



Features (continued)

Monitoring and Metering

- Breaker condition monitoring including breaker arcing current (I_{2t}) and trip counter
- Metering: current, voltage, power, energy and frequency
- Oscillography: 64 samples/cycle, up to 64 records and up to 45s length
- Event recorder: 1024 time tagged events, with 0.5ms scan of digital inputs
- Data logger: up to 16 channels with user selectable sampling rate
- Fault locator

EnerVista™ Software

- State-of-the-art software for the configuration and commissioning of GE Multilin products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the L60 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

L60 Line Phase Comparison System

Sub-Cycle Phase Comparison and Distance Protection

Section 22

Ordering

	L60 - * 00 - H * * - F ** - H ** - L ** - N ** - S ** - U ** - W/X **														For Full Sized Horizontal Mount
Base Unit	L60	E	G	H	J	K	N	T	U	V					Base Unit
CPU															RS485 + RS485 (IEC 61850 option not available)
															RS485 + Multimode ST 10BaseF
															RS485 + Multimode ST Redundant 10BaseF
															RS485 + Multimode ST 100BaseFX
															RS485 + Multimode ST Redundant 100BaseFX
															RS485 + 10/100 BaseT
															RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
															RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT.
															Req FW v7xx or higher
															RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software (see note 1 below)		00													No Software Options
		03													IEC 61850
		A0													CyberSentry UR Lvl 1. Req UR FW 7.xx or higher
		B0													IEEE 1588. Req UR FW 7.xx or higher
		C0													PRP
		D0													IEEE 1588 + CyberSentry. Req UR FW 7.xx or higher
Mount / Coating			H	A	V	B									Horizontal (19" rack) - Standard
															Horizontal (19" rack) - Harsh Chemical Environment Option
															Vertical (3/4 size) - Standard
															Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface				K	L	M	N	O	T	U	V	F	W	Y	Enhanced English Front Panel
															Enhanced English Front Panel with User-Programmable Pushbuttons
															Enhanced French Front Panel
															Enhanced French Front Panel with User-Programmable Pushbuttons
															Enhanced Russian Front Panel
															Enhanced Russian Front Panel with User-Programmable Pushbuttons
															Enhanced Chinese Front Panel
															Enhanced Chinese Front Panel with User-Programmable Pushbuttons
															Vertical Front Panel with English display
															Enhanced Turkish Front Panel
															Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)			H												125 / 250 V AC/DC
			L												125/250 V AC/DC with redundant 125/250 V AC/DC
CT/VT DSP							8P								24 - 48 V (DC only)
								8F							L60 DSP 4CT & 2 Comms Channels + Standard 4CT/4VT (Breaker and Half)
Digital I/O								8L							Standard 4CT/4VT w/ enhanced diagnostics
									XX						No Module
									4A	4A	4A				4 Solid State (No Monitoring) MOSFET Outputs
									4C	4C	4C				4 Solid State (Current w/opt Voltage) MOSFET Outputs
									4D	4D	4D				16 Digital Inputs with Auto-Burnish
									4L	4L	4L				14 Form-A (No Monitoring) Latchable Outputs
									67	67	67	67			8 Form-A (No Monitoring) Outputs
									6C	6C	6C	6C			8 Form-C Outputs
									6D	6D	6D	6D			16 Digital Inputs
									6E	6E	6E	6E			4 Form-C Outputs, 8 Digital Inputs
									6F	6F	6F	6F			8 Fast Form-C Outputs
									6K	6K	6K	6K			4 Form-C & 4 Fast Form-C Outputs
									6L	6L	6L	6L			2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
									6M	6M	6M	6M			2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
									6N	6N	6N	6N			4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
									6P	6P	6P	6P			6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
									6R	6R	6R	6R			2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
									6S	6S	6S	6S			2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
									6T	6T	6T	6T			4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
									6U	6U	6U	6U			6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Transducer I/O							5A		5A	5A	5A				4 dcmA Inputs, 4 dcmA Outputs
							5F		5F	5F	5F				8 dcmA Inputs
Inter-Relay Communications															7A 820 nm, multimode, LED, 1 Channel
															7B 1300 nm, multimode, LED, 1 Channel
															7C 1300 nm, singlemode, ELED, 1 Channel
															7H 820 nm, multimode, LED, 2 Channels
															7I 1300 nm, multimode, LED, 2 Channels
															7J 1300 nm, singlemode, ELED, 2 Channels
															7S G.703, 2 Channels
															7W RS422, 2 Channels
															73 1550 nm, singlemode, LASER, 2 Channels
															77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel
															2B C37.94SM, 1300nm singlemode, ELED, 2 Channel singlemode

Ordering Note: 1. To view all the options available for L60, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=L60>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis.

Visit GEMultilin.com/L60 to:

- View guideform specifications
- Download the instruction manual
- Review application notes and support documents
- Buy a L60 online
- View the UR family brochure

Accessories for the L60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

L30 Line Current Differential System

Cost-Effective Current Differential System for Lines and Cables

Section 22

Key Benefits

- Proven current differential protection ensures secure high-speed tripping
- Increased sensitivity through dynamic charging current compensation and communication channel asymmetry compensation
- Adaptive restraint characteristic provides excellent security against measurement errors including CT saturation
- In-zone power transformer functionality enables savings on CTs and protection device requirements
- Phasor Measurement Unit (synchrophasor) according to IEEE® C37.118 (2011) and IEC® 61850-90-5 support
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE 1588 support
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Advanced fault and disturbance recording, including internal relay operating signals, eliminating the need for external recording devices

Applications

- Overhead lines and underground cables of different voltage levels
- Circuits with tapped transformer feeders
- Suitable for three-terminal line configurations, with channel redundancy and direct transfer tripping (DTT)
- Wide area system monitoring and control and using integrated protection and synchrophasor measurement
- Applications requiring three-pole autoreclosing and independent synchrocheck supervision

Features

Protection and Control

- Line current differential with adaptive restraint and in-zone transformer
- Stub bus protection
- Breaker failure and three-pole autoreclose
- Underfrequency protection
- Phase, ground, neutral and negative sequence time and instantaneous overcurrent
- Thermal overload, phase and neutral directional overcurrent and broken conductor
- Phase over/under voltage, negative sequence overvoltage and four independent synchronism check elements



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, EGD, PRP
- Direct I/O: secure, high-speed exchange of data between L30s for DTT applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Real-time monitoring of remote, local and differential per-phase currents
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- P & M class synchrophasors of voltage, current and sequence components: reporting rate 1 to 120 frames/sec

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad

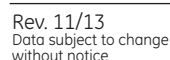


Cost-Effective Current Differential System for Lines and Cables

Ordering

Accessories for the L30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

D90^{PLUS} Line Distance Protection System

Sub-Cycle Distance Protection and Advanced Automation Controller

Section 22

Key Benefits

- Secure sub-cycle distance protection to improve system stability and increase line loading
- True Capacitively Coupled Voltage Transformers (CCVT) filter improves distance protection performance without intentional delays or reduced fault coverage
- Superior phase selection algorithm ensures secure high-speed single-pole tripping
- Reliable and secure protection on lines equipped with series compensation
- Large color HMI with metering, event records and control
- Fault and disturbance recording, including internal relay operating signals at up to 128 samples/cycle
- Built-in phasor measurement unit streaming synchrophasors as per IEEE® C7.118
- Increase network availability by reducing failover time to zero through IEC® 62439-3 “PRP” support
- Configurable alarm annunciator eliminates the need for separate annunciator panel

Applications

- Overhead lines including series compensated lines and underground cables of various voltage levels
- Single and dual-breaker circuits requiring single/three-pole autoreclosing and independent synchrocheck supervision
- Backup protection for generators, transformers and reactors
- True sub-cycle tripping with CCVT
- Circuits with in-zone power transformers and tapped transformer feeders
- Wide area system monitoring and control using integrated protection and synchrophasor measurement

Features

Protection and Control

- Secure time-domain algorithm providing sub-cycle distance protection
- Phase distance with independent compensation settings for in-zone power transformers
- Ground distance with independent self and mutual zero sequence compensation
- Out-of-step tripping and power swing blocking
- Directional overcurrent: phase, neutral and negative sequence
- Wattmetric zero-sequence directional power
- Under/over frequency
- Synchronism check for dual breaker applications
- Single/three-pole four-shot dual breaker autorecloser
- Customization of protection and control functions with independent protection FlexLogic™, FlexCurves™, and FlexElements™
- Advanced automation controller with independent automation programmable logic
- Bay control through front panel HMI



Features (continued)

Monitoring and Metering

- Continuous monitoring of AC input channels
- Metering: current, voltage, frequency, power, energy and synchrophasors as per IEEE C37.118
- Transient recorder: 128 samples/cycle, 1 minute or more of storage capacity
- Disturbance recorder: 1 sample/cycle, 5 minutes or more of storage capacity
- Event recorder: 8000 time tagged events, with 0.5 ms scan of digital inputs
- Comprehensive display of metering, phasors, maintenance and fault information via the front panel

EnerVista™ Software

- Integrated software for configuration and commissioning
- Literature and software toolset to ensure reference material and device utilities are up-to-date

Communications

- Multiple protocols: IEC 61850, DNP 3.0 Level 2, Modbus® RTU, Modbus TCP/IP, IEC 60870-5-104, PRP
- Up to three independent IP addresses
- Front USB port for high-speed communications



Section 22

	D90P	-	*	*	-	*	*	**	*	*	*	*	*	*	*	**	*	*	*	*	*	*	*
Interface			I A H		E																		
Front Panel																							
Language																							
Features																							
Protection					S E A																		
Automation						S E																	
Communications								01 02 03 04 A2 A3 A4															
Metering									S P L U														
DFR										S D													
Equipment Manager											S												
Hardware																							
Harsh Environment Coating											X C												
Power Supply												H											
Peer-to-Peer Communications Module													X										
Communication Module														X A									
AC Module	Type CA Type A01 Type A02																				01 02		
I/O Module	Type IA Type IB Type IC Type ID Type IE Type IF													X A B C D E F	X A B C D E F	X A B C D E F	X A B C D E F	X A B C D E F					

Description

Annunciator (Standard)
+ HMI

English (Standard)

3-pole Distance (Standard)
3-pole Distance + Tele Protection + FlexLogic
1/3-pole Sub-cycle Distance + Series Compensation
+ Tele- Protection + FlexLogic

Breaker Control + Synchrocheck (Standard)
+ Automation FlexLogic

ModBus TCP/IP + ModBus Serial + DNP 3.0 (Standard)
ModBus TCP/IP + IEC 61850
ModBus TCP/IP + IEC 61850 + DNP 3.0 TCP/IP
ModBus TCP/IP + IEC 61850 + IEC 60870-5-104
ModBus TCP/IP, IEC 61850 & PRP
ModBus TCP/IP, IEC 61850, DNP 3.0 TCP/IP & PRP
ModBus TCP/IP, IEC 61850, IEC 60870-5-104 & PRP
+ ModBus TCP/IP + IEC61850 + IEC 60870-5-104

Basic Metering (Standard)
+ Synchrophasors
+ Data Logger

+ Data Logger + Synchrophasors
Transient Recorder + Sequence of Events (Standard)
+ Disturbance Recorder
Circuit Breaker/Communication Statistics + Battery Monitor (Standard)

None (Standard)
Harsh Environment Conformal Coating
High (88-275VAC/80-300VDCI) (Standard)

None (Standard)

None (Standard)
Dual ST fiber & copper
5 VT & 7 CT (5 Amp current) (Standard)

5 VT & 7 CT (1 Amp current)
None
8 Inputs, 4 Form-A Outputs with Voltage + Current Monitoring (Standard)
8 Inputs, 4 Solid State Outputs with Voltage + Current Monitoring
8 Inputs, 4 Form-A Outputs
4 Inputs, 8 Form-A Outputs
23 Inputs
12 Form-A Outputs

D90P - H E - A E 04 U D S - C H X A B C X D 01 X

- View guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a D90^{plus} online



Relays and Meters

Protection and Control

D60 Line Distance Protection System

High-Speed Transmission Line Protection with Single and Three-Pole Tripping

Section 22

Key Benefits

- High-speed, cost-effective five zone quad or mho, phase and ground distance protection
- Reliable and secure protection on series compensated lines
- Superior phase selection algorithm ensures secure high-speed single-pole tripping
- Supports multiple standard pilot schemes for fast fault clearance within the protected zone
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Flexible programmable logic for building customized schemes
- Simplified teleprotection interfaces with direct I/O communications hardware for transfer trip and pilot-aided distance schemes
- Phasor Measurement Unit (synchrophasor) according to IEEE® C37.118 (2011) and IEC® 61850-90-5 support
- Three independent fiber or copper Ethernet ports for simultaneous/dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE 1588 support via LAN with IEEE 1588 support
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs
- Embedded IEC 61850 protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)

Applications

- Overhead lines including series compensated lines and underground cables of different voltage levels
- Single and dual-breaker circuits requiring single/three-pole autoreclosing and independent synchrocheck
- Circuits with in-zone power transformers and tapped transformer feeders
- Secure application with Capacitively-Coupled Voltage Transformers (CCVTs)
- Backup protection for generators, transformers and reactors

Features

Protection and Control

- Phase distance (five zones) with independent compensation settings for in-zone power transformers
- Ground distance (five zones) with independent self and mutual zero sequence compensation
- Reverse power, out-of-step tripping and power swing blocking
- Line pickup, thermal protection, under/over frequency
- Thermal overload, phase, neutral and negative sequence directional overcurrent and broken conductor
- Over, under and rate of change of frequency, synchronism check for dual breaker applications
- Four-shot dual breaker autorecloser broken conductor
- VT fuse failure detector, compensated overvoltage



Features (continued)

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the D60 into new or existing monitoring and control systems

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- P & M Class synchrophasors of voltage, current and sequence components: reporting rate 1 to 120 frames/sec
- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to D60 configurations

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip (DTT) and pilot-aided schemes
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports



Section 22

Ordering

Ordering Notes: 1. To view all the options available for D60, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=D60>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis.

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

D30 Line Distance Protection System

Cost-Effective, High-Speed Primary and Backup Distance Protection

Key Benefits

- Cost-effective, five zone quad or mho, phase and ground distance protection
- Programmable logic for building customized pilot schemes
- Application flexibility: multiple I/O options, programmable logic (FlexLogic™)
- Simplified teleprotection interfaces with direct I/O communications hardware for transfer trip and custom-built pilot-aided distance schemes
- Three independent fiber or copper Ethernet ports for simultaneous/dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE® 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC® 61850 protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Overhead sub-transmission lines and underground cables including series compensated lines.
- Circuits requiring three-pole autoreclosing and independent synchrocheck supervision
- Circuits with in-zone power transformers
- Secure application with Capacitively-Coupled Voltage Transformers (CCVTs)
- Backup protection for generators, transformers and reactors

Features

Protection and Control

- Phase distance (five zones) with independent compensation settings for in-zone power transformers
- Ground distance (five zones) with independent self and mutual zero-sequence compensation
- Out-of-step tripping and power swing blocking
- Line pickup
- Thermal overload, phase, ground, neutral & negative sequence directional overcurrent, and broken conductor elements
- Synchronism check
- Four-shot autorecloser
- VT fuse failure detector
- Customize protection and control functions with FlexLogic, FlexCurves™, and FlexElements™



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip and pilot-aided distance schemes
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to D30 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the D30 into new or existing monitoring and control systems



Cost-Effective, High-Speed Primary and Backup Distance Protection

Ordering Note: 1. To view all the options available for D30, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=D30>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis.

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a D30 online
- View the UR Family brochure

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Selector Guide

page 22-63

Complete bus protection comparison.

A reference table highlighting the feature set for each protection system

B95^{Plus}

page 22-64

Reduce the time and cost of field wiring for bus protection

The B95^{Plus} is a distributed low impedance busbar protection system that utilizes the HardFiber IEC 61850 process bus technology to protect bus schemes up to 24 bays. The B95^{Plus} greatly reduces the time and cost of field wiring for bus protection, and promotes quick expansion to other zones of protection by implementing process bus. The simple, intuitive configuration of the B95^{Plus} reduces the cost of configuring bus protection, and the dynamic element design reduces risk while performing routine bus operations and circuit breaker maintenance.



B90

page 22-66

Low impedance numerical bus differential system

The B90, a member of the UR Family, features integrated protection and breaker failure for re-configurable LV, HV, EHV multi-section busbars with up to 24 feeders. Use one or more B90s together to build a sophisticated protection system that can be engineered to meet specific application requirements. The B90 performs fast and secure low impedance bus protection with a sub-cycle tripping time of 0.75 cycles.



B30

page 22-68

Cost effective bus protection and metering for up to six feeders

The B30, a member of the UR Family, features integrated protection, control and metering for HV and EHV busbars, providing cost effective, feature-focused busbar protection. Use the B30 to protect busbars with up to 6 feeders in a single three phase zone. The B30 is a cost effective alternative to high impedance schemes, ideal for breaker-and-half bus schemes, with integrated feeder backup protection and metering. The B30 performs fast and secure low impedance bus protection with a sub-cycle tripping time of 0.75 cycles.



MIB

page 22-70

High impedance numerical differential protection system

The MIB is a high impedance numerical bus protection relay designed for fast and selective differential protection based on the high-impedance circulating current principle. The MIB is used for the protection of busbars, generators, transformers, reactor against phase-to-phase and phase-to-earth faults. It can be applied for protection of bus bars of different voltage levels.



HID

page 22-71

High impedance differential module

Auxiliary resistors and varistors for high impedance differential schemes. The HID module provides resistors together with voltage limiters (MOVs) normally used in conjunction with a high-speed overcurrent relay to achieve high impedance differential protection. Use the HID in applications that include high impedance differential protection for busbars and electrical machines, such as transformers, generators or motors, as well as restricted earth fault protection.



Relays and Meters Protection and Control Bus Protection Selector Guide

Section 22

Features		ANSI	MIB	B30	B90
Apps	Low impedance Bus differential	87B		•	•
	High impedance Bus differential	87B	•		
	High impedance Restricted Ground Fault	87RGF	•		
Protection & Control	Typical Operating Time (cycles)		<2	<1	<1
	Bus differential	87B	•	•	•
	IOC, Ground/Neutral/Phase	50G/N/P		G/N/P	G/N/P
	TOC, Ground/Neutral/Phase	51G/N/P		G/N/P	G/N/P
	Overvoltage Auxiliary/Neutral	59X/N		X/N	
	Phase Undervoltage	27P		•	•
	Current Transformer Supervision		•	•	•
	Breaker Failure	50BF		•	•
	Breaker Flashover			•	•
	Lockout Functionality	86		•	•
	Dynamic Bus Replica			•	•
	Programmable Logic		•	•	•
	FlexElements™			•	•
Automation	Settings Groups		2	6	6
	Non-volatile latches (up to)			16	16/box
	Contact Inputs Programmable - (up to)		4	80	96/box
	Contact Outputs Programmable - (up to)		4	64	64/box
	Virtual Inputs - (up to)			32	32
	Virtual Outputs - (up to)			64	64
	Direct Inputs/Outputs			•	•
	User-Programmable LEDs (up to)		4	48	48/box
	User-Programmable Push Buttons (up to)			12	12/box
	User-Programmable Self Test			•	•
	User Definable Displays			•	•
	User Programmable Self-Test Contact			•	•
	Timers		•	•	•
	Selector Switch			•	•
	Digital Counters			•	•
	Digital Elements			•	•
	IRIG-B Input			•	•
Monitoring & Metering	Current		•	•	•
	Voltage			•	•
	Symmetrical Components			•	•
	Power - Apparent, Real, Reactive			•	•
	Energy			•	•
	Power Factor			•	•
	Frequency			•	•
	Event Recorder - Number of Events		24	1024	1024
	Oscillography		•	•	•
	Trip/Close Coil Supervision		•	•	•
Comms	RS232 Port		•	•	•
	RS485 Port		•	•	•
	Ethernet Port (Fiber and Copper, up to)			1	1
	Direct Fiber Communications (800nm, 1330nm, 1550nm)			•	•
Protocols	ModBus (RTU and TCP/IP)		•	•	•
	DNP 3.0			•	•
	IEC60870-5-104			•	•
	UCA2/MMS			•	•
	IEC61850			•	•
	Simple Network Time Protocol (SNTP)			•	•
	HTTP			•	•
	TFTP			•	•

* For the most current comparison list see: www.GEMultilin.com/selector/bus.pdf



Relays and Meters

Protection & Control

B95^{Plus} Bus Protection System

Reduce the time and cost of field wiring for bus protection

Key Benefits

- Reduce field wiring costs by replacing multiple copper wires and terminations with a fiber optic cable
- Save installation costs by mounting the bay unit in harsh environments without requiring specialized enclosures
- Increase savings by connecting other relays to the same process bus bay unit
- Protect six three-phase differential zones with one central device

Applications

- Reconfigurable multi-section bus bar with up to 24 feeders
- Retrofit and greenfield installations for power generation, transmission and distribution systems
- Reconfigurable bus bars for single bus, breaker-and-a-half and double bus with and without bus couplers
- Air-insulated and GIS stations

Features

Saves Field Wiring

- Terminate field wiring directly at bay unit located at the primary equipment
- Install connectorized fiber optic cable as only wiring across the switchyard
- Transfer work of designing, installing and commissioning field wiring for new installations to primary equipment suppliers

Use as Distributed I/O

- The bay unit can be a distributed I/O interface for any protective relay
- Environmentally hardened, compact design allows installation in a substation without additional cost or equipment
- Measurements and commands transmitted via IEC 61850 message formats
- Interface to protective relays that support appropriate sampled value message formats per IEC 61850

Section 22



Features (continued)

Meets Protection Needs

- Meets requirements for speed and reliability of bus protection for all configurations and voltage levels
- 6 zones of 3-phase protection and 24 feeders for breaker-and-a-half, double bus and segmented bus zones
- CT saturation detector capable of detecting CT saturation even with only 2 msec of saturation free current for enhanced fault stability
- Reconfigurable dynamic bus replica



Relays and Meters

Protection & Control

B95^{Plus} Bus Protection System

Section 22

Reduce the time and cost of field wiring for bus protection

Ordering

														Slot							Description	
B95P														A	B	C	E	F	G	H		J
Interface	-	*	*	-	*	*	**	*	*	*	-	*	*	*	*	*	*	*	*	*	*	
Front Panel Language		H	E																		Annunciator + HMI (Standard) English (Standard)	
Features																						
Protection					S	B															Dynamic Bus Differential Protection (Standard) Dynamic Bus Differential Protection with Breaker Failure	
Automation					X																None	
Communications							01														ModBus TCP/IP (Standard) + IEC 61850 + IEC61850 + DNP 3.0 TCP/IP + IEC61850 + IEC 60870-5-104	
							02															
							03															
							04															
Metering								S													AC Input Phasors + Differential & Restraint Phasors (Standard)	
DFR									S												Transient Recorder + Sequence of Events (Standard)	
Equipment Manager										X											None	
Hardware																						
Harsh Environment Coating											X	C									None (Standard) Harsh Environmental Conformal Coating	
Power Supply													H								High (88-275Vac/80-300Vdc) (Standard)	
Peer-to-Peer Communications Module														X							None (Standard)	
Communication Module															A						Dual ST Fiber & Copper (Standard)	
URPlus Process Card																X	X	X	X	X	None	
(If only one process card, it must be in slot J)																		P		P	Each Supports 8 Bricks & 12 Bus/Voltage Sources	

Brick														Description						
CT/VT Inputs																				
														C	C	5	5	Standard Brick with Eight 5 A CT Inputs		
														C	V	5	0	Standard Brick with Four 5 A CT Inputs and Four VT Inputs		
														C	C	1	1	Standard Brick with Eight 1 A CT Inputs		
														C	V	1	0	Standard Brick with Four 1 A CT Inputs and Four VT Inputs		

Order Code Example

(1) B95P - H E - B X 03 S S X - X H X A X P X X P X
 (12) Brick - 4 - H I - C C 5 5

Note: the order code is for a B95^{Plus} system. The B95^{Plus} provides bus differential protection for 6 zones, annunciator and display, breaker failure protection. IEC 61850 and DNP 3.0 communications, metering, transient fault recording, and 2 process cards to support connections for up to 16 Bricks. This system also includes 12 Bricks with eight 5 A current inputs each.



Relays and Meters

Protection and Control

B90 Low Impedance Bus Differential System

Section 22

Secure, Dependable and Scalable Bus Differential Protection System for LV, HV and EHV Busbars

Key Benefits

- High-speed protection algorithm for enhanced stability with trip times of 0.75 power cycle
- Superior CT saturation detector capable of detecting CT saturation even with only 2 msec of saturation free current for enhanced through fault stability
- Suitable for different bus configurations, scalable architecture to protect up to 24 feeders
- Pre-engineered bus protection system: use experienced GE Digital Energy application engineers to develop busbar protection system for your specific configurations
- Three independent fiber or copper Ethernet ports for simultaneous/dedicated network connections with advanced 1 microsecond time-synchronization via LAN with IEEE® 1588 support
- Use high-speed communications to reduce wiring and installation costs, exchange inputs and outputs between relays to achieve relay-to-relay interaction
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- Increase network availability by reducing failover time to zero through IEC® 62439-3 "PRP" support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)

Applications

- Re-configurable multi-section busbar with up to 24 feeders
- Single bus, breaker-and-a-half bus bar configurations, double bus and triple bus with and without bus couplers

Features

Protection and Control

- Multi-zone bus differential protection with restrained and unrestrained function
- Fast and reliable CT saturation detection
- Breaker failure protection
- End fault (dead zone) protection
- Check-zone functionality
- CT ratio mismatch compensation
- Dynamic bus replica
- Backup time and instantaneous overcurrent elements
- Undervoltage function for supervision purposes



Features (continued)

Communications

- Networking options: up to three Ethernet ports 100Mb fiber or copper, RS422, RS485, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0, Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104 and PRP
- Direct I/O: secure, high-speed exchange of data between URs

Monitoring and Metering

- Isolator monitoring (up to 48) and alarming
- CT trouble monitoring
- VT supervision
- Metering: current, voltage, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger

EnerVista™ Software

- State-of-the art software for configuring and commissioning Multilin products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the B90 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

Section 22

B90 Low Impedance Bus Differential Protection System

Secure, Dependable and Scalable Bus Differential Protection System for LV, HV and EHV Busbars

Ordering

(Please Contact GE Energy for Engineered Bus Protection Solutions)

	B90 -	*	*	-H	*	*	-F**	-H**	L**	N**	S**	U**	-W/X**		For full sized horizontal mount
Base Unit	B90	E	G	H	J	K	N	T	U	V					Base Unit
CPU															RS485 + RS485 (IEC 61850 option not available)
															RS485 + 10BaseF
															RS485 + Redundant 10BaseF
															RS485 + Multimode ST 100BaseFX
															RS485 + Multimode ST Redundant 100BaseFX
															RS485 + 10/100 BaseT
															RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
															RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher
															RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)		0	1	2	4	5	6	A0	B0	C0	D0				Without Breaker Failure
															With Breaker Failure (With Engineered Solution Only)
															8-feeders, 4 zones
															16-feeders, 4 zones
															24-feeders, 4 zones
															8-feeders, 4 zones, IEC 61850
															16-feeders, 4 zones, IEC 61850
															24-feeders, 4 zones, IEC 61850
															CyberSentry UR Lvl 1 + 08 feeders, 04 zones
															IEEE 1588 + 08 feeders, 04 zones
															PRP
															IEEE 1588 + CyberSentry UR Lvl 1 + 08 feeders, 04 zones
Mount/ Coating															Horizontal (19" rack)
															Horizontal (19" rack) - Harsh Chemical Environment Option
User Interface															Enhanced English Front Panel
															Enhanced English Front Panel with User-Programmable Pushbuttons
															Enhanced French Front Panel
															Enhanced French Front Panel with User-Programmable Pushbuttons
															Enhanced Russian Front Panel
															Enhanced Russian Front Panel with User-Programmable Pushbuttons
															Enhanced Chinese Front Panel
															Enhanced Chinese Front Panel with User-Programmable Pushbuttons
															Vertical Front Panel with English display
															Enhanced Turkish Front Panel
															Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)															125 / 250 V AC/DC
															125 / 250 V AC/DC with redundant 125/250 V AC/DC
															24 - 48 V (DC only)
CT/VT DSP															Standard 4CT/4VT
															Standard 8CT
															Standard 7CT/1VT
Digital I/O															No module
															4 Solid State (No Monitoring) MOSFET Outputs
															4 Solid State (Current w/opt Voltage) MOSFET Outputs
															16 Digital Inputs with Auto-Burnish
															14 Form-A (No Monitoring) Latchable Outputs
															8 Form-A (No Monitoring) Outputs
															8 Form-C Outputs
															16 Digital Inputs
															4 Form-C Outputs, 8 Digital Inputs
															8 Fast Form-C Outputs
															4 Form-C & 4 Fast Form-C Outputs
															2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
															2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
															4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
															6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
															2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
															2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
															4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
															6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
Inter-Relay Communications															820 nm, multimode, LED, 1 Channel
															1300 nm, multimode, LED, 1 Channel
															820 nm, multimode, LED, 2 Channels
															1300 nm, multimode, LED, 2 Channels
															G.703, 2 Channels
															RS422, 2 Channels
															IEEE C37.94, 820 nm, multimode, LED, 2 Channel

Ordering Note: 1. To view all the options available for B90, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=B90D>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Visit GEMultilin.com/B90 to:

- View Guideform specifications
- Download the instruction manual
- Review application notes and support documents
- Buy a B90 online
- View the UR Family brochure

Accessories for the B90

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection and Control

B30 Bus Differential System

Section 22

Cost-Effective Low Impedance Biased Bus Differential Protection For Up to Six Feeders

Key Benefits

- High-speed differential protection algorithm for enhanced stability with sub-cycle trip times of 0.75 power cycle
- Superior CT saturation detector capable of detecting CT saturation even with only 2 msec of saturation free current for enhanced through-fault stability
- Cost-effective alternative to high impedance schemes protection
- Advanced automation capabilities for providing customized protection and control solutions
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Three independent fiber or copper Ethernet ports for simultaneous/dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE® 1588 support
- Embedded IEC® 61850 protocol with no external communications hardware required
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- High-end fault and disturbance recording, including internal relay operating signals, eliminating the need for redundant recording devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Re-configurable and pre-defined bus arrangements for simple bus applications, up to 6 feeders and 2 differential zones with breaker failure
- Integrated bus protection and metering for HV and EHV substations

Features

Protection and Control

- Differential protection with restrained and unrestrained function
- Fast and reliable CT saturation detection
- Breaker failure protection
- External check-zone
- CT ratio mismatch compensation
- Dynamic bus replica
- Thermal overload and backup phase, ground and neutral time and instantaneous overcurrent protection
- Undervoltage function for supervision purposes



Features (continued)

Communications

- Networking options: up to three Ethernet ports 100Mb fiber or copper, RS422, RS485, G.703, C37.94 and up to 45s in length
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus serial/TCP, IEEE 1588, IEC 60870-5-104, EGD, PRP
- Direct I/O: secure high-speed exchange of binary data between URs

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Isolator monitoring
- CT trouble monitoring, VT supervision
- Metering: current, voltage, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the B30 into new or existing monitoring and control systems



Relays and Meters

Protection and Control

B30 Bus Differential System

Section 22

Cost-Effective Low Impedance Biased Bus Differential Protection For Up to Six Feeders

Ordering

B30 - * ** - H * - F ** - H ** - L ** - N ** - S ** - U ** - W **													For Full Sized Horizontal Mount
Base Unit	B30												Base Unit
CPU	E G H J K N T U V												RS485 + RS485 (IEC 61850 option not available) RS485 + 10BaseF RS485 + Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 BaseT RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)	00 03 A0 B0 C0 D0												No Software Options IEC 61850 CyberSentry UR Lvl 1. Req UR FW 7.xx or higher IEEE 1588. Req UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry UR. Req UR FW 7.xx or higher
Mount/Coating		H A											Horizontal (19" rack) Horizontal (19" rack) - Harsh Chemical Environment Option
User Interface			K L M N O Q T U V C W Y										Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Basic Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)			H L									RH	125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC power supply 24 - 48 V (DC only)
CT/VT DSP				8L 8M 8N 8R		8L 8M 8N 8R		8L 8M 8N 8R					Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 8CT w/ enhanced diagnostics 8 Port IEC 61850 Process Bus Module
IEC 61850 Process Bus					81								No module
Digital I/O					XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V 5A 5F		XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V 5A 5F		XX 4A 4C 4D 4L 67 6C 6D 6E 6F 6K 6L 6M 6N 6P 6R 6S 6T 6U 6V 5A 5F			4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital 2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs 4 dcmA Inputs, 4 dcmA Outputs 8 dcmA Inputs	
Transducer I/O													
Inter-Relay Communications												2B 7A 7B 7C 7H 7I 7J 7S 7W 77	C37.94SM, 1300nm singlemode, ELED, 2 channel singlemode 820 nm, multimode, LED, 1 Channel 1300 nm, multimode, LED, 1 Channel 1300 nm, singlemode, ELED, 1 Channel 820 nm, multimode, LED, 2 Channels 1300 nm, multimode, LED, 2 Channels 1300 nm, singlemode, ELED, 2 Channels G.703, 2 Channels RS422, 2 Channels IEEE C37.94, 820 nm, multimode, LED, 2 Channel

Ordering Note: 1. To view all available model order codes, options for B30 or to order the UR Classic Front Panel, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=B30>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Visit GEMultilin.com/B30 to:

- View Guideform specifications
- Download the instruction manual
- Review application notes and support documents
- Buy a B30 online
- View the UR Family brochure

Accessories for the B30

—UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection & Control

HID High Impedance Differential Module

Auxiliary resistors and varistors for high impedance differential schemes

Key Benefits

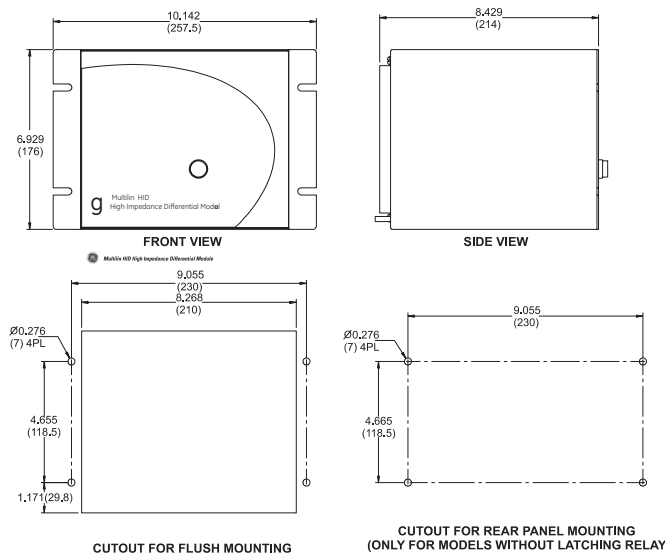
- Includes 2000-ohm resistors to provide security against the effects of CT saturation for through faults
- Provides metal oxide varistors (MOV) to clamp secondary peak voltage to less than 2 kV
- Use the HID in conjunction with an overcurrent relay for a separate phase, neutral, and negative-sequence overcurrent elements, including instantaneous, definite-time, and inverse time-overcurrent elements for backup overcurrent protection.

Applications

- Single-zone bus protection, reactor protection, or sensitive restricted earth fault protection on grounded, wye-connected power transformer windings
- High impedance differential protection for electrical machines such as generators or motors, including lockout logic.



Dimensions



Visit www.GEMultilin.com/HID to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a HID online

Ordering

HID	*	*	Application
1			1 winding transformer REF - 1 resistor + 1 MOV
2			2 winding transformer REF - 2 resistors + 2 MOV
3			Busbar Applications 3 High impedance differential elements
			Latching relay / Power supply
0			Without latching relay
1			48 Vdc latching relay
2			125 Vdc latching relay
3			220 Vdc latching relay



Relays and Meters

Protection & Control

Distribution Feeder Protection

Section 22

Selector Guide

page 22-74

Complete distribution feeder protection product comparison

A reference table highlighting the feature set for each system

F60

page 22-76

Advanced protection, control and automation solutions for distribution feeders

The F60, a member of the UR Family of protection relays, provides high performance feeder protection, control, monitoring and metering in an integrated, economical, and compact package. The F60 includes GE Multilin™'s unique high impedance fault detection for fast and reliable detection of downed conductors.

F35

page 22-78

Cost-effective protection and control for single/multiple distribution feeders

The F35, a member of the UR Family of protection relays, provides cost-effective feeder protection, control and metering for up to five feeders with busbar voltage measurement, or six feeders without busbar voltage in one integrated package. Use the F35 as a stand-alone device or as a component of an automated substation control system.

750/760

page 22-80

Draw-out feeder protection and control for industrial and utility feeders

The 750/760 Feeder Protection System, a member of the SR Family of protection relays, with draw out capability intended for primary protection and management of distribution feeders. The 750/760 has specific features for industrial environments, including a drawout case to limit downtime during maintenance and conformal coating for harsh environments.

F650

page 22-82

Comprehensive feeder protection with bay controller

The F650, a member of the 650 Family of protection relays, incorporates protection, control, automation and metering in a economical package. F650 comes with a large LCD and single line diagrams can be built for bay monitoring and control for various feeder arrangements including ring-bus, double breaker or for breaker and half.

350

page 22-84

Intuitive and innovative feeder protection

The 350 is a member of the new SR 3 series family of protection and control devices from Multilin. This cost-effective protective device is used to perform primary circuit protection on low and medium voltage feeders. The protection functions of this relay include multiple phase, ground, and neutral time and instantaneous overcurrent elements, plus essential feeder breaker control features such as cold load pickup blocking, breaker failure, and auto-reclose. The 350 also offers enhanced features such as diagnostics, preventative maintenance, arc-flash mitigation and security.

A60

page 22-86

Advanced light and pressure arc flash detection system

The Multilin A60™ Arc Flash System utilizes GE's patented light and pressure signal fiber sensor to help ensure fast and reliable protection against arcing events. Based on a known time relationship between the speed of light and sound, (pressure wave), GE's patented sensor is able to detect and issue a trigger signal to clear the fault in under 2 milliseconds – significantly reducing incident energy from an arc flash event.

735/737

page 22-87

Three-phase and ground feeder protection for medium and low voltage

The 735/737, a member of the SR Family of protection relays, provides primary protection for distribution feeders. The 735/737 has specific features for industrial environments, including a drawout case to limit downtime during maintenance and conformal coating for harsh environments.



Relays and Meters Protection & Control Distribution Feeder Protection

Section 22

MIF II

[page 22-88](#)

Economical feeder protection with recloser

The MIF II is a member of the M II Family of protection relays. MIF II provides comprehensive overcurrent protection with multi-shot recloser. Also, MIF II can be utilized to provide backup/auxiliary protection for transformers, generators and motors.

FM2

[page 22-89](#)

Economical and compact feeder protection for low voltage feeders

The Feeder Manager 2 (FM2) combines control functions and feeder protection in one package. This compact device provides sophisticated control and protective relaying at significant cost savings over the discrete devices normally found in a low voltage power control center (PCC).

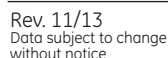


Features	Device	FM2	350
Protection & Control			
Current Disturbance Detector	50DD		
Synchronism Check	25		
Undervoltage, Phase/Auxiliary	27 P/X		
Directional Power	32		
Directional, Phase/Neutral/ Ground/ Negative Seq.	67P/N/G/_2		
Wattmetric Zero Seq. Directional			
Breaker Failure	50BF		•
IOC, Phase/Neutral/Ground/Negative Seq.	50 P/N/G/_2	G	P/G
IOC, Sensitive Ground			•
TOC, Phase/Neutral/Ground/ Negative Seq.	51 P/N/G		P/G
TOC, Sensitive Ground			
Custom programmable overcurrent curve			
Restrictive Ground Fault			
High Impedance Fault Detection (Hi-Z)			
Load Encroachment Logic			
Overvoltage, Phase/Auxiliary/Neutral/ Negative Seq.	59P/X/N		
AC Reclosing (Shots)	79		4
Underfrequency	81U		
Overfrequency	81O		
Lockout Protection			
Broken Conductor Detection			
Programmable Elements			
Voltage Transformer Fuse Failure			
Cold Load Pickup			•
FlexElements™			
Automation			
Settings Groups			2
Contact Inputs (Up to)		16	2
Contact Outputs (Up to)		6	5
Non-volatile latches			
User-Programmable Push Buttons (Up to)			
Graphical Display			
Trip/Close Coil Supervision			
Breaker Control		•	•
Programmable Logic			•
User-Programmable LEDs			•
Timers		•	•
Digital Counters			
Digital Elements			
Selector Switch			
Analog Inputs/Outputs (Up to)			
RTD Inputs			
Automatic Transfer Scheme			
Undervoltage Restoration		•	
Underfrequency Restoration			
Monitoring & Metering			
Current		•	•
Voltage		•	
Power Factor			
Real, Reactive & Apparent Power		•	
Current, MW, MVAR, MVA Demand			
Energy		•	
Frequency			
Frequency Decay			
Analog Inputs			
Fault Location			
Event Recorder - Number of Events		1	256
Oscillography - Sampling Rate			32
Breaker Arcing Current			•
Data Logger		•	
THD & Harmonics Meter			
Communications			
RS232 Port			•
RS485 Port		•	•
RS422 Port, G.703, C73.94			
Ethernet			
Fiber (800nm, 1300nm, 1550nm)			
ModBus (RTU/TCP/IP)		•	•
DNP3 Protocol			•
IRIG-B Input			
EGD Protocol			
TCP/IP			•
Simple Network Time Protocol			•
IEC 60870-5-104			•
IEC61850 Protocol			•



Selector Guide

Section 22

[illegible]

Relays and Meters

Protection & Control

F60 Feeder Protection System

Advanced Protection, Control and Automation Solutions for Distribution Feeders

Section 22

Key Benefits

- The most flexible protection and control device for distribution feeder applications
- Unique and secure downed conductor detection, backed by many years of field experience
- Flexible load encroachment allows secure operation during heavy load conditions
- Voltage and frequency elements provide load shedding & transfer schemes for increased system uptime and stability
- Application flexibility with multiple I/O options and programmable logic (FlexLogic™)
- Phasor Measurement Unit (synchrophasor) according to IEEE® C37.118 (2011) and IEC® 61850-90-5 support
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC 61850 protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Advanced fault and disturbance recording, including internal relay operating signals, eliminating the need for redundant recording devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Primary protection and control for feeders on solidly, impedance or resonant (Petersen coil) grounded systems
- Busblocking/interlocking schemes
- Distribution load shedding schemes based on voltage and frequency elements
- High-speed fault detection for arc flash mitigation
- Throw over schemes (bus transfer scheme applications)
- Backup protection for transmission lines, feeders and transformers
- Distributed Generation (DG) interconnect protection

Features

Protection and Control

- High-impedance fault detection (downed conductor detection)
- Directional, time, instantaneous, phase, neutral, negative sequence and ground overcurrent protection
- Load encroachment supervision
- Wattmetric ground fault detection
- Thermal overload, incipient cable fault detection and broken conductor
- Four-shot autorecloser with synchronism check
- Breaker control and breaker failure
- Abnormal frequency protection (rate of change, under/over frequency)



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, IEEE C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for DG, distribution automation applications

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency and harmonics
- P & M class synchrophasors of voltage, current and sequence components: 1 to 120 frames/sec
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to F60 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the F60 into new or existing monitoring and control systems



Advanced Protection, Control and Automation Solutions for Distribution Feeders

Ordering

	F60	- *	** - H	* -	* -	F ** -	H ** -	M ** - P ** -	U ** - W **	For Full Sized Horizontal Mount
Base Unit	F60									Base Unit
CPU		E								RS485 + RS485 (IEC 61850 option not available)
		G								RS485 + Multimode ST 10BaseF
		H								RS485 + Multimode ST Redundant 10BaseF
		J								RS485 + Multimode ST 100BaseFX
		K								RS485 + Multimode ST Redundant 100BaseFX
		N								RS485 + 10/100 BaseT
		T								RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
		U								RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher
		V								RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)		00								No Software Options
		03								IEC 61850
		06								PMU
		07								IEC 61850 + PMU
		A0								CyberSentry Lvl 1. Req UR FW 7.xx or higher
		B0								IEEE 1588. Req UR FW 7.xx or higher
		C0								PRP
		D0								IEEE 1588 + CyberSentry. Req UR FW 7.xx or higher
Mount / Coating			H							Horizontal (19" rack) - Standard
			A							Horizontal (19" rack) - Harsh Chemical Environment Option
			V							Vertical (3/4 size) - Standard
			B							Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface				K						Enhanced English Front Panel
				L						Enhanced English Front Panel with User-Programmable Pushbuttons
				M						Enhanced French Front Panel
				N						Enhanced French Front Panel with User-Programmable Pushbuttons
				Q						Enhanced Russian Front Panel
				T						Enhanced Russian Front Panel with User-Programmable Pushbuttons
				U						Enhanced Chinese Front Panel
				V						Enhanced Chinese Front Panel with User-Programmable Pushbuttons
				F						Vertical Front Panel with English display
				W						Enhanced Turkish Front Panel
				Y						Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)					H				RH	125 / 250 V AC/DC
					L					125/250 V AC/DC with redundant 125/250 V AC/DC power supply
CT/VT DSP										24 - 48 V (DC only)
						8F				Standard 4CT/4VT
						8G				Sensitive Ground 4CT/4VT
						8H				Standard 8CT
						8J				Sensitive Ground 8CT
						8L		8L		Standard 4CT/4VT w/ enhanced diagnostics
						8M		8M		Sensitive Ground 4CT/4VT w/ enhanced diagnostics
						8N		8N		Standard 8CT w/ enhanced diagnostics
						8R		8R		Sensitive Ground 8CT w/ enhanced diagnostics
						8Z		8Z		HI-Z 4CT (high impedance fault detection)
IEC 61850 Process Bus							8I			8 Port IEC 61850 Process Bus Module
Digital I/O							XX	XX	XX	No module
							4A	4A	4A	4 Solid State (No Monitoring) MOSFET Outputs
							4C	4C	4C	4 Solid State (Current w/opt Voltage) MOSFET Outputs
							4D	4D	4D	16 Digital Inputs with Auto-Burnish
							4L	4L	4L	14 Form-A (No Monitoring) Latchable Outputs
							67	67	67	8 Form-A (No Monitoring) Outputs
							6C	6C	6C	8 Form-C Outputs
							6D	6D	6D	16 Digital Inputs
							6E	6E	6E	4 Form-C Outputs, 8 Digital Inputs
							6F	6F	6F	8 Fast Form-C Outputs
							6K	6K	6K	4 Form-C & 4 Fast Form-C Outputs
							6L	6L	6L	2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
							6M	6M	6M	2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
							6N	6N	6N	4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
							6P	6P	6P	6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
							6R	6R	6R	2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
							6S	6S	6S	2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
							6T	6T	6T	4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
							6U	6U	6U	6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
							6V	6V	6V	2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
Transducer I/O							5C	5C	5C	8 RTD Inputs
							5E	5E	5E	4 dc mA Inputs, 4 RTD Inputs
							5F	5F	5F	8 dc mA Inputs
Inter-Relay Communications										7A 820 nm, multimode, LED, 1 Channel
										7B 1300 nm, multimode, LED, 1 Channel
										7C 1300 nm, singlemode, ELED, 1 Channel
										7H 820 nm, multimode, LED, 2 Channels
										7I 1300 nm, multimode, LED, 2 Channels
										7J 1300 nm, singlemode, ELED, 2 Channels
										7S G.703, 2 Channels
										7W RS422, 2 Channels
										76 IEEE C37.94, 820 nm, multimode, LED, 1 Channel
										77 IEEE C37.94, 820 nm, multimode, LED, 2 Channel

Ordering Note: 1. To view all the options available for F60, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=F60>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type, Maximum 2 per chassis

Accessories for the F60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters

Protection & Control

F35 Feeder Protection System

Cost-Effective Protection and Control for Single/Multiple Distribution Feeders

Section 22

Benefits

- Cost-effective and flexible protection and control device for distribution feeder applications
- Improved system stability at reduced cost with control schemes using high-speed communications
- Phasor Measurement Unit (synchrophasor) according to IEEE® C37.118 (2011) and IEC® 61850-90-5 support
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC 61850 protocol with no external communications hardware required
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- High-end fault and disturbance recording, including internal relay operating signals, eliminating the need for redundant recording devices
- Accurate built-in metering functions eliminate auxiliary metering devices and reduces cost
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Primary protection and control for multiple distribution feeders
- Distribution load shedding schemes based on voltage and frequency elements
- Busblocking/interlocking schemes
- Throw over schemes (bus transfer scheme applications)
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

Features

Protection and Control

- Instantaneous and time phase overcurrent protection
- Thermal overload, instantaneous and time ground/neutral/ negative sequence overcurrent protection, wattmetric ground fault directional
- Neutral and auxiliary overvoltage
- Phase and auxiliary undervoltage
- Under frequency
- Four shot autoreclose for up six breakers and broken conductor elements
- Built-in selector switch



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, IEEE C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to F35 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the F35 into new or existing monitoring and control systems



Relays and Meters

Protection & Control

F35 Feeder Protection System

Cost-Effective Protection and Control for Single/Multiple Distribution Feeders

Section 22

Ordering

	F35	-	*	**	-	H	*	*	-	F**	-	H**	-	M	**	-	P**	-	U	**	-	W	*	For Full Sized Horizontal Mount
Base Unit	F35																							Base Unit
CPU																								RS485 + RS485 (IEC 61850 option not available)
																								RS485 + Multimode ST 10BaseF
																								RS485 + Multimode ST Redundant 10BaseF
																								RS485 + Multimode ST 100BaseFX
																								RS485 + Multimode ST Redundant 100BaseFX
																								RS485 + 10/100 BaseT
																								RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
																								RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT.
																								Req FW v7xx or higher
																								RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)																								No Software Options
																								IEC 61850
																								CyberSentry UR Lvl 1. Req UR FW 7.xx or higher
																								IEEE 1588. Req UR FW 7.xx or higher
																								PRP
																								IEEE 1588 + CyberSentry UR. Req UR FW 7.xx or higher
Mount / Coating																								Horizontal (19" rack) - Standard
																								Horizontal (19" rack) - Harsh Chemical Environment Option
																								Vertical (3/4 size) - Standard
																								Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface																								Enhanced English Front Panel
																								Enhanced English Front Panel with User-Programmable Pushbuttons
																								Enhanced French Front Panel
																								Enhanced French Front Panel with User-Programmable Pushbuttons
																								Enhanced Russian Front Panel
																								Enhanced Russian Front Panel with User-Programmable Pushbuttons
																								Enhanced Chinese Front Panel
																								Enhanced Chinese Front Panel with User-Programmable Pushbuttons
																								Vertical Front Panel with English display
																								Enhanced Turkish Front Panel
																								Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)																								125 / 250 V AC/DC
																								125/250 V AC/DC with redundant 125/250 V AC/DC power supply
																								24 - 48 V (DC only)
CT/VT DSP																								Standard 4CT/4VT
																								Sensitive Ground 4CT/4VT
																								Standard 8CT
																								Sensitive Ground 8CT
																								Standard 4CT/4VT w/ enhanced diagnostics
																								Sensitive Ground 4CT/4VT w/ enhanced diagnostics
																								Standard 8CT w/ enhanced diagnostics
																								Sensitive Ground 8CT w/ enhanced diagnostics
IEC 61850 Process Bus																								8 Port IEC 61850 Process Bus Module
Digital I/O																								No Module
																								4 Solid State (No Monitoring) MOSFET Outputs
																								4 Solid State (Current w/opt Voltage) MOSFET Outputs
																								16 Digital Inputs with Auto-Burnish
																								14 Form-A (No Monitoring) Latchable Outputs
																								8 Form-A (No Monitoring) Outputs
																								8 Form-C Outputs
																								16 Digital Inputs
																								4 Form-C Outputs, 8 Digital Inputs
																								8 Fast Form-C Outputs
																								4 Form-C & 4 Fast Form-C Outputs
																								2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
																								2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
																								4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
																								6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
																								2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
																								2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
																								4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
																								6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
																								2 Form-A (No Monitoring) Outputs, 4 Digital Inputs
																								2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
Transducer I/O																								4 dcmA Inputs, 4 dcmA Outputs
																								8 RTD Inputs
																								4 RTD Inputs, 4 dcmA Outputs
																								4 dcmA Inputs, 4 RTD Inputs
																								8 dcmA Inputs
Inter-Relay Communications																								7A
																								820 nm, multimode, LED, 1 Channel
																								7B
																								1300 nm, multimode, LED, 1 Channel
																								7C
																								1300 nm, singlemode, ELED, 1 Channel
																								7H
																								820 nm, multimode, LED, 2 Channels
																								7I
																								1300 nm, multimode, LED, 2 Channels
																								7J
																								1300 nm, singlemode, ELED, 2 Channels
																								7S
																								G.703, 2 Channels
																								7T
																								RS422, 1 Channel
																								7W
																								RS422, 2 Channels
																								76
																								IEEE C37.94, 820 nm, multimode, LED, 1 Channel
																								77
																								IEEE C37.94, 820 nm, multimode, LED, 2 Channel

Ordering Note: 1. To view all the options available for F35, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=F35>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Accessories for the F35

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850

Visit www.GEMultilin.com/F35 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a F35 online
- View the UR Family brochure



Relays and Meters

Protection & Control

750/760 Feeder Protection System

Section 22

Comprehensive, draw out distribution feeder protection and management

Key Benefits

- Easy to use Feeder Protection System supported by industry leading suite of software tools
- Accurate built-in metering functions - Eliminates auxiliary metering devices and reduces cost
- Improve uptime of auxiliary equipment - I/O monitoring
- Reduce troubleshooting time and maintenance costs - IIRIG-B time synchronization, event reports, waveform capture, data logger
- Minimize replacement time - Draw-out construction
- Simplify testing - Built in simulation features
- Cost effective access information - Embedded 10MB Ethernet port for system integration. Supports industry protocols such as DNP 3.0 & Modbus
- Complete asset monitoring - Analog I/O, Full metering including demand & energy
- Leading edge technology - Flash memory for product field upgrade
- Extended life - Optional conformal coating for chemically corrosive and humid environments
- Globally accepted - Member of the most renowned product family in the market.

Applications

- Primary protection and control for distribution feeders on solidly grounded, high impedance grounded or resonant (Peterson Coil) grounded systems
- Bus blocking/Interlocking schemes
- High-speed fault detection for arc flash mitigation
- Throw over schemes (bus transfer scheme applications)
- Load shedding schemes based on voltage and frequency elements
- Back-up protection for transmission lines, feeders and transformers
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

Features

Protection and Control

- Directional time, instantaneous phase overcurrent protection
- Directional time, instantaneous ground overcurrent protection
- Directional sensitive ground and Restricted Earth Fault protection
- Negative sequence overcurrent protection
- Bus and line undervoltage
- Overvoltage
- Neutral overvoltage
- Underfrequency/Frequency decay
- Reverse power protection
- Synchro Check
- Automatic bus transfer
- Manual control
- Cold load pickup control
- Power factor control



Features (continued)

- 4 shot recloser (760 only)
- Power factor control
- Synchrocheck - V, f, Hz, & dead-source

Communications

- Networking interfaces - 10Mbps Ethernet, RS232, RS485 and RS422 ports
- Ethernet port, 10Mbps —Multiple protocols - ModBus® RTU, ModBus® RTU, TCP/IP, DNP 3.0 Level 2

Monitoring and Metering

- Metering - current, voltage, sequence components per, power, energy, voltage
- Breaker operation & trip failure
- Event recording - 128 time tagged events
- Total breaker arcing current
- Ambient temperature /analog transducer input
- Analog transducer input
- Oscillography & Data Logger - 10 records up to 32 power cycles
- Simulation mode and playback capability.

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the 750/760 into new or existing monitoring and control systems



Relays and Meters

Protection & Control

750/760 Feeder Protection System

Section 22

Comprehensive, draw out distribution feeder protection and management

Ordering

750/760	*	*	*	*	*	*	*	*	Description
Phase Current Inputs	P1								1 A phase current inputs
	P5								5 A phase current inputs
Ground Current Inputs		G1							1 A zero sequence current inputs
		G5							5 A zero sequence current inputs
Sensitive Ground Current Inputs			S1						1 A sensitive ground current input
			S5						5 A sensitive ground current input
Power Supply Options				LO					20 – 60 VDC, 20 – 48 VAC @ 48 – 62 Hz
				HI					88 – 300 VDC, 70 – 265 VAC @ 48 – 62 Hz
Analog Outputs					A1				Eight 0 – 1 mA analog outputs
					A5				Eight 0 – 5 mA analog outputs
					A10				Eight 0 – 10 mA analog outputs
					A20				Eight 4 – 20 mA analog outputs
Breaker Status LED						R			Red breaker closed LED
						G			Green breaker closed LED
Enhancements							E		Enhanced display, larger LCD, improved keypad
							T		Enhanced display with Ethernet 10BaseT option
Environmental Protection								H	Harsh Chemical Environment Option

Accessories for the 750/760

Feeder Protection with the SR750/760	TRCD-SR750-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-G1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring	VP-1

Ordering Note: This order code is valid for the latest version of SR hardware and firmware version. The older hardware and previous firmware versions are still available and may be ordered through the usual channels.

Visit www.GEMultilin.com/750 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 750/760 online
- View the SR Family brochure



F650 Feeder Protection and Bay Controller System

Cost effective solution for protection, automation and control of distribution feeders

Key Benefits

- Flexible protection and control device for distribution feeder applications
- Advanced automation capabilities for providing customized protection and control solutions
- Human machine interface (HMI) - graphical LCD, programmable buttons, and rotary knob for selecting setting menus, and submenus.
- Minimize replacement time - Modular with card draw-out construction
- Reduce troubleshooting time and maintenance costs - IRIG-B and SNTP time synchronization, event reports, waveform capture, data logger
- Voltage and frequency based load shedding and transfer schemes to increase system uptime and improve system stability
- Advanced automation capabilities for providing customized protection and control solutions
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Simplified system integration with communications supporting serial and Ethernet interfaces and multiple protocols
- Reduced relay to relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC61850 Protocol

Applications

- Primary protection and control for distribution feeders on solidly grounded, high impedance grounded or resonant (Peterson Coil) grounded systems —Bus blocking/Interlocking schemes
- High-speed fault detection for arc flash mitigation
- Throw over schemes (bus transfer scheme applications)
- Load shedding schemes based on voltage and frequency elements
- Back-up protection for transmission lines, feeders and transformers
- Distributed Generation (DG) interconnect protection, including active and passive anti-islanding

Features

Protection and Control

- Time, instantaneous & directional phase, neutral, ground and sensitive ground overcurrent
- Manual close with cold load pickup control via PLC, Forward Power and Directional Power Units
- Load encroachment supervision
- Wattmetric ground fault detection
- Positive and negative sequence based over/under voltage elements
- Four-shot autorecloser with synchronism check
- Breaker control and breaker failure
- Abnormal frequency protection (Rate of change, under and over frequency)



Features (continued)

Monitoring and Metering

- Fault locator, record of last 10 faults -metering - current, voltage, power, energy, frequency and harmonics
- Breaker operation & trip failure
- Total breaker arcing current
- Event recorder - 479 Events
- High resolution oscillography and Data Logger, with programmable sampling rate
- Metering: V I Hz W VA PF
- Demand: Ia , Ib , Ic , Ig, Isg, I2, MW, MVA
- Configurable graphical HMI interface
- Alarm Panel

EnerVista™ Software

- Sophisticated software for configuration and commissioning
- Document and software archiving
- EnerVista™ Integrator providing easy integration of data in the F650 into new or existing monitoring and control systems

Relays and Meters Protection & Control

Section 22

F650 Feeder Protection and Bay Controller System

Cost effective solution for protection, automation and control of distribution feeders

Ordering

F650	*	*	*	F	G	*	*	*	*	*	DESCRIPTION
F650	I										DIGITAL BAY MANAGEMENT DEVICE
	B										Basic display (4 x 20 characters)
	M										Graphical display with standard symbols (240x128 pixels)
	N										Graphic display with IEC Symbols (240x128 pixels)
											REAR SERIAL COMMUNICATIONS BOARD 1
		F									None
		A									Redundant RS485
		P									Redundant plastic fiber optic
		G									Redundant glass fiber optic
		X									Redundant RS485 + fiber remote CAN bus I/O
		Y									Redundant plastic fiber optic + fiber remote CAN bus I/O
		Z									Redundant glass fiber optic + fiber remote CAN bus I/O
		C									Cable Remote CAN Bus I/O
		M									RS485 + cable Remote CAN Bus I/O
			B								REAR ETHERNET COMMUNICATIONS BOARD 2
			C								10/100 Base TX
			D								10/100 Base TX + 100 Base FX
			E								10/100 Base TX + Redundant 100 Base FX
											Redundant 10/100 Base TX
				1							I/O BOARD IN SLOT F
				2							16 Digital Inputs + 8 Outputs
											8 Digital Inputs + 8 Outputs + 2 trip/close circuit supervision circuits
				4							32 Digital Inputs
				5							16 Digital Inputs + 8 Analog Inputs
											I/O BOARD IN SLOT G
					0						None
					1						16 Digital Inputs + 8 Outputs
					4						32 Digital Inputs (See Note 1)
					5						16 Digital Inputs + 8 Analog Inputs (See Note 1)
						LO					AUXILIARY VOLTAGE
						HI					24-48 Vdc (range 19.2 - 57.6)
											110-250 Vdc (range 88 - 300)
						LOR					120-230 Vac (range 96 - 250)
						HIR					Redundant LO
											Redundant HI
											LANGUAGE
							-				English/English
							C				Chinese/English (See Note 2)
							F				French/English
							P				Russian/English (See Note 2)
							S				Spanish/English
											COMMUNICATION PROTOCOL
							-				Modbus ® RTU, TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104
							5				Procome, Modbus ® RTU, TCP/IP
							6				IEC61850, Modbus ® RTU and TCP/IP, DNP 3.0 Level 2, IEC 60870-5-104
											ENVIRONMENTAL PROTECTION
							-				Without Harsh (Chemical) Environment Conformal Coating
							H				Harsh (Chemical) Environment Conformal Coating

SPECIAL MODELS:

MOD001: 6A output contacts instead of 16A..

(*) Notes:

(1) The number selected for option G must be equal or higher than the number selected for option F for models including boards 4 and 5.

(2) Russian and Chinese languages available only for basic display models.
Chinese Basic Display: 2x20 characters for English characters, 2x10 characters for Chinese characters.

Accessories for the F650

Feeder Protection with the F650	TRCD-F650-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC61850	VP-1-61850

Ordering Note: This order code is valid for the latest version of F650 hardware and firmware version.
The older hardware and previous firmware versions are still available and may be ordered through the usual channels.

Visit www.GEMultilin.com/F650 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a F650 online
- View the 650 Family brochure



Relays and Meters

Protection & Control

350 Feeder Protection System

Intuitive and Innovative Feeder Protection

Section 22

Key Benefits

- Easy to use and intuitive overcurrent protection and control for feeder applications.
- Effortless draw-out construction eliminates requirement for test switches and reduces downtime
- Environmental monitoring system to alarm on destructive operating conditions and plan preventative maintenance
- Easy to use interface and set up in one simple step
- Accelerated Life Cycle Tested to ensure reliability of relay operation under abnormal conditions
- Advanced power system diagnostics to increase reliability through fault and disturbance recording capabilities
- Flexible communications with multiple ports & protocols to allow seamless integration into new and existing infrastructure
- Arc flash mitigation via zone inter-tripping, flex curves, and multiple settings group
- Powerful Security Audit Trail tool to increase security and minimize system risks by tracking setting changes
- Application flexibility with the use of programmable logic elements

Applications

- Industrial feeders with enhanced breaker monitoring diagnostics, etc.
- Distribution utility down stream breaker protection
- Medium voltage Utility feeders with advanced control features Cold Load Pickup, auto reclose, multiple settings group, etc

Features

Protection and Control

- Phase, neutral and ground TOC and IOC
- Undervoltage, overvoltage, frequency
- Neutral/ground directional
- Negative sequence Overcurrent
- ANSI, IAC, IEC, flex curves
- Cable Thermal Model Protection
- Breaker Failure
- Cold Load Pick Up
- Four-shot auto-reclose
- 8 digital inputs, 7 contact outputs
- Two setting groups

Metering & Monitoring

- Event Recorder: 256 events
- Oscillography with 32 samples per cycle
- IRIG-B clock synchronization
- Relay health diagnostics
- Security audit trail
- Metering - current, voltage, power, frequency



Features (continued)

User Interface

- 4 line display for easy viewing of key data
- 10 LED indicators for quick diagnostics
- Front USB and rear RS485 serial communications
- Multiple Communication Protocols:
 - IEC 61850
 - IEC 61850 GOOSE,
 - MODBUS TCP/IP, MODBUS RTU,
 - DNP 3.0, IEC 60870-5-104, IEC 60870-5-103

EnerVista™ Software

- EnerVista Software- an industry-leading suite of software tools that simplifies every aspect of working with Multilin devices.
- Quick & easy configuration requiring minimal settings for most feeder applications.



Relays and Meters

Protection & Control

350 Feeder Protection System

Intuitive and Innovative Feeder Protection

Section 22

Ordering

	350	E	**	**	*	*	*	*	*	**	D	*	Description
Base Unit	350	E											English
Language		E											English
Phase Currents			P1										1A three phase current inputs
			P5										5A three phase current inputs
Ground Currents				G1									1A ground current input
				G5									5A ground current input
				S1									1A sensitive ground current input
				S5									5A sensitive ground current input
Power Supply				L									24 - 48 Vdc
				H									125 - 250 Vdc/120 - 240Vac
Faceplate					S								Standard faceplate (LCD, full menu, actual values and setpoints) with 8 Inputs, 7 Outputs (2 Form A, 5 Form C) --- Only for 350
					E								Standard faceplate (LCD, full menu, actual values and setpoints) with 10 Inputs, 7 Outputs (2 Form A, 5 Form C)
Current Protection						S							Standard Overcurrent Protection - 50P(1), 50G(1), 50N(1), 51P(1), 51G(1), 51N(1)
						E							Extended Overcurrent Protection - 49, 50P(2), 50G(2), 50N(2), 51P(1), 51G(1), 51N(1)
						M							Advanced overcurrent protection - 49, 50P(2), 50G(2), 50N(2), 51P(1), 51G(1), 51N(1), 50_2 (46)
Control							N						No Selection
							C						CLP, 50BF, Autoreclose (79), Lockout (86)
Options								N					No Selection
								D					Directional Neutral Overcurrent Protection 67N(1), 67G(1)
								M					Voltage Metering
								R					Neutral and Ground Directional elements 67N(1), 67G(1) + Voltage Metering
								P					Voltage Protection, Neutral and Ground Directional elements - 27P(1), 27X(1), 59P(1), 59N(1), 59X(1), 59_2(1), 81O(2), 81U(2), 67N(1), 67G(1)
Communications									SN				Standard :Front USB, Rear RS485 : Modbus RTU, DNP3.0, IEC 60870-5-103
									1E				Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104
									2E				Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850
									3E				GOOSE
Case Design										D			Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850
Harsh Environment											D		Draw-out Design
										N			None
										H			Harsh Environment Conformal coating

Note: 1) G1/G5 and S1/S5 must match corresponding P1/P5 - there cannot be 5A and 1A mixing

Accessories for the 350

Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850

Visit www.GEMultilin.com/350 to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a 350 online
- View the 350 brochure



Relays and Meters
Protection & Control
A60™ Feeder Protection System

Advanced Light & Pressure Arc Flash Detection System

Key Benefits

- GE patented, dual input light and pressure wave sensors for fast, reliable arc flash detection
- Arc flash detection and trip initiation in as fast as 1ms to reduce equipment damage and increase system uptime
- Independent device provides continuous, always on, operation to maximize equipment protection
- Continuous health monitoring of optical sensors, fiber cables, and control unit to ensure reliable operation
- Direct connection to breaker trip circuit using solid state output relays, for increased operating speed
- Multi-stage detection for reduced nuisance tripping with optional external current supervision input
- Simplified installation and configuration with sensor auto-calibration and no requirement for additional setup software
- Up to 5 arc flash sensors per unit provides optimized coverage for Switchgear compartments
- Multiple unit connectivity and transfer trip capability to ensure optimized coverage for large applications
- No requirement to install additional CTs reducing time and costs associated with installation and commissioning
- DIN rail mounted for easy installation and reduced commissioning time
- Suitable for both new and retrofit applications

Applications

- Arc flash detection system for medium voltage applications (switchgear and motor control centers)
- Applications requiring arc flash mitigation
- Suitable for new and existing retrofit applications



Features

- GE patented, high-speed arc flash system utilizing light and pressure wave detection technology
- Stand-alone unit providing continuous operation, 24/7
- Continuous self-supervision (health monitoring) of sensors, fiber cables, and arc flash relay with trouble indication
- External current supervision from IOC device
- Up to five arc flash sensors per relay for detection in multiple locations within switchgear
- Five solid state output relays for fast trip initiation
- Six digital inputs with transfer trip capability for cascading applications
- Arc flash sensor auto-calibration
- Three LEDs for indication for Status, Trip, and Trouble
- Local and remote reset capability
- DIN Rail mounting
- Slide switches and rotary dial for device setup
- No setup software required
- Operating temperature range from -40°C to +60°C

Ordering

A60	E	H	*	*	Description
Language	E				English
Power Supply		H			125 - 250V DC / 100 - 240V AC, 50/60 Hz
Sensors			X		Qty 0 to 5 - 6ft Sensors
				X	Qty 0 to 5 - 12ft Sensors

NOTE: Qty 5 sensors maximum per Multilin A60, minimum 1 sensor required



Relays and Meters

Protection & Control

735/737 Feeder Protection System

Three-phase and ground feeder protection

Section 22

Key Benefits

- Minimize replacement time - Draw-out construction
- Simplify testing - Built in simulation features
- Access information - via Modbus RTU

Applications

- Primary circuit protection on distribution networks at any voltage level
- Backup protection for transformers and transmission lines

Features

Protection and Control

- 3 phase time overcurrent
- Ground time overcurrent
- 5 curve shapes
- 4 curve shift multipliers per curve
- 10 time multipliers per curve
- ANSI, IAC, or IEC/BS142 curves
- Phase instantaneous overcurrent
- Ground instantaneous overcurrent
- Pickup level for each overcurrent
- Outputs: trip, aux trip, service
- Aux trip: 86 lockout, ground trip
- SR737 has 8 additional output relays

Features (continued)

Communications

- 8 LED trip indicators
- 4 LED status indicators
- Current bar graph, % of CT
- RS485 or RS422 communications
- ModBus® RTU protocol
- Baud rate up to 19,200 bps

Monitoring and Metering

- Trip record of last 5 trips
- Pre-trip data includes currents
- True RMS sensing

EnerVista™ Software

- EnerVista™ software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices
- EnerVista™ Integrator providing easy integration of data in the 735/737 into new or existing monitoring and control systems



Ordering

*	*	*	*	*	
735					Standard relay with 50/51, 50G/51G protection
737					Relay with 8 additional outputs
	1				1 A phase CT secondaries
	5				5 A phase CT secondaries
		1			1 A ground CT secondaries
		5			5 A ground CT secondaries
			LO		20 - 60 VDC; 20 - 48 VAC @ 50, 60 Hz control power
			HI		90 - 300 VDC; 70 - 265 VAC @ 50, 60 Hz control power
				485	RS485 2-wire communications (standard)
				422	RS422 4-wire communications (optional)

Accessories

19-1 PANEL	Single cutout panel
19-2 PANEL	Dual cutout panel
SCI	RS232 to RS485 convertor
735/737-DEMO	737 demo/test case
1 3/8" Collar:	For shallow switchgear, reduces the depth of the relay by 1 3/8".
3" Collar:	For shallow switchgear, reduces the depth of the relay by 3".

Visit www.GEMultilin.com/735 to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a 735/737 online

Consider upgrading the 735/737 to the 750/760 for increased functionality and optional ethernet communication interface.



Relays and Meters

Protection & Control

MIF II Feeder Protection System

Economical feeder protection with recloser

Section 22

Key Benefits

- Low priced scalable options – event reports, waveform capture, reclosure
- Reduce troubleshooting and maintenance cost – Event reports, waveform capture
- Design flexibility – Easy to use programming logic
- Asset monitoring – Breaker health, and breaker failure
- Access to information – Modbus RTU communications
- Configurable logic, curves, I/Os and LEDs
- Flash memory for field upgrades
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Improved user interface
- Access via front panel keypad or communication links
- EnerVista™ compatible
- Isolated front RS232 serial port

Applications

- Primary feeder protection on distribution networks
- Backup/auxiliary protection for transformers, generators and motors

Features

Protection and Control

- Phase and ground TOC and IOC
- Thermal image protection
- IAC time-current curves
- EPTAR-C time-current curves
- Circuit breaker control (open and close)
- Four shot autorecloser
- Cold load pickup element
- Configurable breaker failure to open
- Configurable I/O
- 6 outputs: trip, service required, 4 auxiliary

Visit www.GEMultilin.com/MIFII to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIF II online
- View the MIF II brochure



Features (continued)

Monitoring and Metering

- 32-event record
- Analog/digital oscillography
- KI² counter for breaker maintenance
- Per phase current metering
- Monitoring of the last 5 trips information from the display

User Interfaces

- EnerVista™ for setting and monitoring
- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and colour.
- Independent front RS232 and rear RS485
- Multiple Protocols - ModBus RTU, IEC60870-5-103

EnerVista™ Software

- EnerVista™ software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices
- EnerVista™ Integrator providing easy integration of data in the MIFII into new or existing monitoring and control systems

Ordering

MIF II	*	*	*	*	*	*	*	00	
P									3 phase + ground relay
N									Single phase or ground relay
A									ANSI curves
I									IEC curves
U									IAC curves
C									EPTAR-C curves (only for single phase model)
	0								MIF II N models
	1								MIF II P models: Phase CT in = 1 A
	5								MIF II P models: Phase CT in = 5 A
		1							Ground CT In = 1 A
		5							Ground CT In = 5 A
		N							Sensitive ground: CT In = 1 A
		L							Very sensitive ground: CT In = 1 A
			E						English language
			F						French language
				0					MIF II Basic Model
				1					MIF II Option 1 *
				2					MIF II Option 2 **
					O				Without recloser
					R				With recloser (not available in the Basic Model)
						L			24-48 VDC (Range: 19~58 Vdc) Power Supply
						O			110-250 VDC (Range: 88~300 Vdc) Power Supply
						H			110-230 VAC (Range: 88~264 Vac) Power Supply

* Configurable I/O/LEDs, event recording, oscillography

** Option 1 + cold load pickup, breaker failure to open, breaker health, configurable logic



Relays and Meters

Protection & Control

FM2 Feeder Protection System

Economical and compact feeder protection for low voltage feeders

Section 22

Key Benefits

- Comprehensive low voltage feeder management system - Integrated feeder protection and process control in a small package
- Cost effective solution - Low cost modular design
- Small footprint and compact design - With or without display, fits into standard Power Control Center buckets
- Ease of use - EnerVista™ compatible
- Remote monitoring - via serial communications, Modbus RTU
- Easy installation and integration - Door mount option
- Reduced number of devices - Replaces of bi-metal overload elements, integrates timers, relays, meters, switches, indicators
- Integrated trip pushbutton
- Easy to read two line display



Applications

- Feeder protection and management system for low voltage distribution feeders
- Integrated process and electrical control
- Specifically designed for Power Control Center applications

Features

Protection and Control

- Thermal overload protection
- Current unbalance
- Ground fault protection
- Open contactor/Welded contactor
- Under voltage autoreclose
- Outputs: 2 fixed, 1 programmable and 1 emergency shutdown
- Inputs: 6 fixed, 10 programmable

Monitoring and Metering

- Display phase current, ground current, current unbalance, voltage, power, energy, etc.
- Trip record and pre-trip values
- Maintenance information

Communications

- RS485 ModBus®, 1200 - 19,200 bps
- Front Panel 11 LEDs, key pad, and 2x20 LCD display
- Front Panel control push buttons
- Includes EnerVista™ software

EnerVista™ Software

- EnerVista™ software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices
- EnerVista™ Integrator providing easy integration of data in the FM2 into new or existing monitoring and control systems

Ordering

FM2 * - * - * - *				
Base Unit	FM2			Product Family
Model	712			120V AC VT and Switch input voltage
	722			240V AC VT and Switch input voltage
		PD		Panel mount with Display
		C		Chassis mount (Black box)

Visit www.GEMultilin.com/FM2 to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a FM2 online
- View the FM2 brochure



Relays and Meters

Protection & Control

Motor Protection

Section 22

[Selector Guide](#)

[page 22-92](#)

Complete motor protection comparison

A reference table highlighting the feature set for each protection system

[M60](#)

[page 22-94](#)

Comprehensive protection for medium to large motors

The M60 provides superior protection, control, and diagnostics that include thermal model with RTD and current unbalance biasing, stator differential, reverse and low forward power, external RRTD module, two-speed motors, reduced voltage starting, broken rotor bar detection, and more.



[469](#)

[page 22-96](#)

Comprehensive protection and control of medium and large AC motors

The SR469 Motor Protection System, a member of the SR family of relays provide protection for three phase motors. It is a cost effective draw-out unit for protection, fault diagnostics, metering, and communication applications ideally suited for industrial installations. It may be used for applications for two speed motors as well as for applications where single CT differential protection is required.



[369](#)

[page 22-97](#)

Integrated protection and control for medium sized AC motors

Designed for medium-sized motors, the enhanced 369 Motor Protection System delivers advanced motor health diagnostics, graphical and data rich fault diagnostics, simple six-step setup & amp; configuration and complete traceability of setting changes, enabling industrial facilities to maximize process up-time and optimize rated motor output.



[339](#)

[page 22-101](#)

Intuitive protection for AC motors

Designed for medium voltage motors in industrial applications, the 339 delivers unparalleled protection, control, diagnostics and communications in an industry leading draw-out construction. The 339 Motor Protection System provides simplified setup configuration through the use of the Motor Settings Auto-Configurator, advanced graphical diagnostics with the Motor Health Report and support for multiple communication protocols including IEC 61850.



[269^{Plus}](#)

[page 22-103](#)

Protection for three-phase industrial motors and driven equipment

The 269^{Plus} Motor Management Relay™ detects damaging conditions of the motor. This relay learns motor parameters and may be adapted to any application and initial protection may be improved. Relay is available in draw-out and standard version. This relay monitors ten RTD's.



[239](#)

[page 22-104](#)

Protection for three-phase industrial motors and driven equipment

The 239 Motor Protection relay is designed to provide protection and control for small to medium size motors and the associated mechanical equipment. Optional switches allow for protection of multi-speed motors.



Relays and Meters Protection & Control Motor Protection

Section 22

MM300™

[page 22-105](#)

Comprehensive low voltage motor management including automation and diagnostics

The MM300™ integrates advanced motor protection, control automation, communication and diagnostics into a single rugged, flexible device for low voltage motors. Designed to be mounted in MCCs in harsh plant environments, the MM300™ combines protection and PLC functionality in a small, modular hardware platform.

MM2

[page 22-107](#)

Integrated process and electrical control with protection for low voltage motors

The MM2 controller can be used in applications where integrated process control with protection for low voltage motors is required. This controller replaces relays, meters, panel indicators and reduces field wiring.

SPM

[page 22-109](#)

Starting protection, synchronization and control for synchronous motors

The SPM motor system is used for control, synchronization and specific protection (stator protection have to be done by one an induction motor protection relay) of collector-ring or brushless synchronous motors.

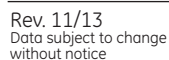


Features	Device	MM200	MM300
Protection & Control			
Thermal Model	49	•	•
RTD Biasing	49RTD		•
Current Unbalance Biasing		•	•
Custom Overload Curves			
Voltage Dependant Overload Curves			
Jogging Start / Starts-Per-Hour	66		•
Incomplete Sequence	48	•	•
Reduced Voltage Starting	19		•
Backspin Detection			
Two Speed Motor			•
Emergency Restart			•
Jam / Stall	51R	•	•
IOC, Phase, Ground, Sensitive Grnd, Neutral	50P/G/SG/N	G	G
TOC, Phase, Ground, Sensitive Grnd	51P/G/SG/		G
Differential	87M		
Current Directional, Phase, Ground, Neutral	67P/G/N		
Current Unbalance	46	•	•
Undercurrent / Underpower	37	•	•
Phase, Auxiliary, Neutral Overvoltage	59P/N/X		P
Phase, Auxiliary Undervoltage	27P/X	X	P/X
Negative Sequence Overvoltage	59_2		
Voltage Transformer Fuse Failure	VFFF		•
Phase Reversal	47		•
Under / Overfrequency	81U/O		
Reverse Power	32R		
Power Factor	55		
RTD Overtemperature	49		•
Remote RTD (IRRTD)	49		
Breaker Failure	50BF		
Automation			
Contact Inputs (max)		7 DC/6 AC	30
Contact Outputs (max)		3	18
Analog Inputs (max)			
Analog Outputs (max)			
RTD Inputs (max)			6
Thermistor Input		•	•
Programmable Logic			•
Trip / Close Coil Supervision			
Digital Counters		•	•
Timers			•
Undervoltage Auto-restart			•
Monitoring & Metering			
Current		•	•
Voltage			•
Frequency			•
Power - Real			•
Power - Apparent / Reactive			•
Power Factor			•
Demand - Current, MW, MVA, Mvar			
Energy			•
Temperature			•
Event Recorder (number of events)			256
Oscillography (max samples per cycle)			32
Data logger			•
Motor Learned Information		•	•
Thermal Capacity Used		•	•
Motor Start Data Logger			
Motor Start / Stop Health Report			
Communications			
RS232 Serial Communications		•	•
RS485 Serial Communications		•	•
Ethernet Communications			•
Fiber Optic Ethernet			
Modbus protocol		•	•
DeviceNet protocol		•	•
Profibus protocol		•	•
DNP 3.0 protocol			
IEC61870-5-105 protocol			
IEC61850 protocol			
Peer-to-Peer Communications (GSSE/GOOSE)			
Simple network Timesync protocol			•
IRIG-B input			
Process Bus (IEC 61850-9-2)			



Selection Guide

Section 22

[illegible]

Relays and Meters

Protection & Control

M60 Motor Protection System

Comprehensive Protection for Medium to Large Motors

Section 22

Key Benefits

- Advanced motor protection and control elements including a flexible and powerful thermal model and standard, custom and voltage dependant overload curves
- Integrated automation and process control functions
- Simplified programming with the EnerVista™ M60 motor settings auto-configurator
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with 1 microsecond time synchronization via LAN with IEEE® 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Increase network availability by reducing failover time to zero through IEC® 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- High-end fault and disturbance recording
- Enhanced motor-learned data provides critical information for preventative maintenance
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Protection and control of most popular construction type medium to large three-phase induction motors
- Automation or process control functionality
- Protection of medium to large synchronous motors when paired with the SPM Synchronous Motor Protection System
- Stand-alone protection or component in automated substation control system

Features

Protection and Control

- Enhanced thermal model with RTD and current unbalance compensation
- Stator differential
- Mechanical jam/stall
- Short circuit tripping
- Under current/under power
- Phase reversal
- Reverse/low forward power protection
- Two-speed motor protection
- Reduced voltage starting
- Optional internal RTDs & external RTD module
- CT failure for each CT bank, VT fuse failure



Features (continued)

Communications

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, EGD, IEC 60870-5-104, PRP
- DeviceNet and Profibus protocol options available using the D485 and P485 protocol converters
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip (DTT) applications

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to M60 configurations
- Motor starting characteristics for the last 250 motor starts

EnerVista Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the M60 into new or existing monitoring and control systems



Relays and Meters

Protection & Control

M60 Motor Protection System

Comprehensive Protection for Medium to Large Motors

Section 22

Ordering

Base Unit	M60	-	*	00	-	H	*	-	F	**	-	H	**	-	M	**	-	P	**	-	U	**	-	W/X**	For full sized horizontal mount						
CPU		E	G	H	J	K	N	T	U	V															Base Unit RS485 + RS485 (IEC 61850 option not available) RS485 + Multimode ST 10BaseF RS485 + Multimode ST Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 BaseT RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher No Software Options IEC 61850 CyberSentry UR Lvl 1. Req UR FW 7.xx or higher IEEE 1588. Req UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry UR. Req UR FW 7.xx or higher						
Software Options (see note 1 below)		00	03	A0	B0	C0	D0																		Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option						
Mount / Coating				H	A	V	B																		Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons						
User Interface					K	L	M	N	O	T	U	V	F	W	Y										125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC 24 - 48 V (DC only) 24 - 48 V (DC only) with redundant 24 - 48 V (DC only)						
Power Supply (see note 2 below)						H	H	L																	Standard 4CT/4VT w/ enhanced diagnostics Sensitive Ground 4CT/4VT w/ enhanced diagnostics Standard 8CT w/ enhanced diagnostics Sensitive Ground 8CT w/ enhanced diagnostics 8 Port IEC 61850 Process Bus Module						
CT/VT DSP								8L	8M	8N	8R														No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs						
IEC 61850 Process Bus											81														8 RTD Inputs 4 dcma Inputs, 4 RTD Inputs 8 dcma Inputs						
Digital I/O											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N	6P	6R	6S	6T	6U	6V	
											XX	4A	4C	4D	4L	67	6C	6D	6E	6F	6K	6L	6M	6N							

Ordering Note: 1. To view all available model order codes, options for M60 or to order the UR Classic Front Panel, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=M60>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Accessories for the M60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-F1
Remote RTD Module	RRTD
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850
D485 DeviceNet Converter	D485-C
P485 Profibus Converter	P485-C



Relays and Meters

Protection & Control

469 Motor Protection System

Complete integrated protection and management of medium and large motors

Key Benefits

- Comprehensive motor protection plus voltage dependant overload curves, torque metering and protection, broken rotor bar protection
- Most advanced thermal model - Including multiple RTD inputs for stator thermal protection
- Minimize replacement time - Draw-out construction
- Complete asset monitoring - Temperature, Analog I/O, full metering including demand & energy
- Improve uptime of auxiliary equipment - Through I/O monitoring
- Reduce troubleshooting time and maintenance costs - Event reports, waveform capture, data logger
- Built in simulation functions simplify testing and commissioning
- Cost Effective Access to information - Through standard RS232 & RS485 serial ports, and optional Ethernet and DeviceNet Ports
- Field upgradable firmware and settings
- Optional Conformal coating for exposure to chemically corrosive or humid environments



Applications

- Protection and Management of three phase medium and large horsepower motors and driven equipment, including high inertia, two speed and reduced-voltage start motors.

Features

Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Start supervision and inhibit
- Mechanical jam
- Voltage compensated acceleration
- Undervoltage, overvoltage
- Underfrequency
- Stator differential protection
- Thermal overload
- Overtemperature protection
- Phase and ground overcurrent
- Current unbalance
- Power elements
- Torque protection
- Dual overload curves for 2 speed motors
- Reduced voltage starting control

Features (continued)

Communications

- Multiple Ports - 10baseT Ethernet, RS485, RS232, RS422, DeviceNet
- Multiple Protocols - Modbus RTU, Modbus TCP/IP, DeviceNet

Monitoring and Metering

- A, V, W, var, VA, PF, Hz, Wh, varh, demand
- Torque, temperature (12 RTDs)
- Event recorder
- Oscillography & Data Logger (trending)
- Statistical information & learned motor data

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the 469 into new or existing monitoring and control systems

Ordering

469	*	*	*	*	*	
469	P1	LO	A1	D	H	Basic Unit
	P5	HI	A20	E		1 A phase CT secondaries
				T		5 A phase CT secondaries
						DC: 24 - 60 V; AC: 20 - 48 V @ 48 -62 Hz control power
						DC: 90 - 300 V; AC: 70 - 265 V @ 48 -62 Hz control power
						0 - 1 mA analog outputs
						4 - 20 mA analog outputs
						DeviceNet
						Enhanced front panel
						Enhanced front panel with Ethernet 10BaseT option
						Harsh (Chemical) Environment Conformal Coating

Accessories for the 469

469 Motor Protection Learning CD	TRCD-469-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-G1
Product Maintenance Learning CD	TRCD-MAINT-C-S-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring	VP-1

Visit www.GEMultilin.com/469 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 469 online



Relays and Meters

Protection & Control

369 Motor Protection System

Integrated protection and control for medium sized AC motors

Section 22

Key Benefits

- Enhanced Thermal Model including RTD and Current Unbalance Biasing
- Complete Asset monitoring with programmable RTD inputs for Stator, Bearing and Ambient temperature protection
- Enhanced reporting - Motor Health Reports provide critical information for preventative maintenance
- Reduce troubleshooting time and maintenance costs -Event reports, waveform capture, motor start, data logger
- Simplify testing - Built in simulation features
- Multiple communication protocols - Modbus RTU, Profibus, DeviceNet, Modbus TCP/IP
- Cost Effective Access to information - Through standard RS232 & RS485 serial ports, and optional Ethernet, DeviceNet, and Profibus Ports
- Simplified programming with the EnerVista™ 369 Motor Settings Auto-Configurator
- Field upgradable settings and firmware
- Optional Conformal coating for exposure to chemically corrosive or humid environments
- Suitable for hazardous locations - Underwriters Laboratory certification for Class 1 Division 2 applications
- Installation flexibility - Remote display and remote RTD options
- Safe and reliable motor re-start on “Down Hole” pump applications - Unique back spin detection feature detects flow reversal on a pump motor, enabling timely and safe motor restarting

Applications

- Protection and control for medium sized AC motors
- “Down Hole” pump applications
- Suitable for applications involving Variable Frequency Drives

Features

Protection and Control

- Enhanced thermal model
- Stall / Jam protection
- Undervoltage, overvoltage
- Underfrequency
- Thermal overload
- Undercurrent/current unbalance
- Variable lockout time
- Ground fault O/C
- Overtemperature 12 RTDs (R option)
- Starts/hour, time between starts
- Phase Reversal (M option)
- Undervoltage Auto-restart
- Two Speed Motor Protection

User Interface

- 40 Character Backlit LCD Display
- 10 System and Motor Status LED's
- Keypad for configuration and viewing metered values
- 4 programmable analog outputs
- 369 Motor Settings Wizard



Features (continued)

Monitoring and Metering

- Metering - current, voltage, power, energy, frequency, RTD Temperature, Remote RTD
- Fault diagnosis, - Event Record, Oscillography, Motor Starting Data Logger
- Motor Start / Stop Health Report
- Statistical information & learned motor data
- Voltage/frequency/power display (M option)
- 4 analog outputs (M option)

Communications

- Front Panel RS232 port for programming and troubleshooting
- Optional embedded Ethernet port
- Optional Profibus DP/DPV1 or DeviceNet via dedicated port
- ModBus® RTU
- ModBus® over TCP/IP

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the 369 into new or existing monitoring and control systems



Section 22

Ordering

Accessories for the 369

Visit www.GEMultilin.com/369 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 369 online



Drawout 269^{Plus} to Drawout 369 Motor Protection System

Replace a 269/269^{Plus} Motor Management Relay with a Drawout 369 Motor Protection System

Key Benefits

- Utilizes the same 269/269^{Plus} drawout chassis, significantly reducing cost and system downtime
- Automated setting file conversion tool simplifies the upgrade process
- Eliminates the need for mounting kits and re-work to existing cut-outs or frames
- Provides advanced protection features including a user configurable thermal model
- Comprehensive asset monitoring and diagnostics including Motor Learned Data and Motor Health Reports for optimized asset performance
- Reduce troubleshooting time and maintenance costs with detailed event recorder, oscillography and data logger capabilities
- Suitable for hazardous locations, UL certification for Class 1 Div 2 applications

Applications

- Protection and control for medium sized, three-phase, AC motors
- Two speed motors

Features

Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Enhanced thermal model
- Stator winding and bearing overtemperature monitoring and protection
- Jogging start / starts-per-hour
- Incomplete sequence
- Undercurrent for load loss
- Locked rotor
- Rapid trip / mechanical jam / stall protection
- Unbalance / single phasing
- Short circuit & ground fault
- Variable lock-out time
- Emergency restart capability



Features (continued)

EnerVista™ Software

- Automated 269^{Plus} setting file conversion tool with conversion report to verify settings
- State of the art software for configuration and commissioning Multilin products

Monitoring and Metering

- Current and thermal capacity metering
- Data logger
- Event recorder (max 512 events)
- Oscillography (max 16 samples per cycle)
- Motor learned information
- Motor start / stop health report

Inputs / Outputs

- Contact inputs / outputs: 5 / 4
- Analog outputs: 1
- RTD inputs: 12

Communications

- RS232 serial communications
- RS485 serial communications
- Modbus RTU protocol

User Interface

- 40 character LCD display
- 10 system and motor status LEDs
- Keypad for configuration and viewing metered values



Relays and Meters

Protection & Control

Section 22

Drawout 269^{Plus} to Drawout 369 Motor Protection System

Replace a 269/269^{Plus} Motor Management Relay with a Drawout 369 Motor Protection System

Ordering

269 ^{Plus}	*	*	*	*	*	*		269 ^{Plus} motor management relay®
269 ^{Plus}	SV							Standard version
	D/O							Drawout version
		1						Phase CT¹
		2						Ground CT (required for D/O only)
		3						:5 2000:1
		4						:5 :5
								:1 2000:1
								:1 :5
								Relay fail safe code² (required for D/O only)
		1						Trip Alarm Aux1 Aux 2
		2						FS NFS NFS FS
		3						NFS FS NFS FS
		4						FS FS NFS FS
		5						NFS NFS FS FS
		6						FS NFS FS FS
		7						NFS FS FS FS
		8						FS FS FS FS
								NFS NFS NFS FS
								Relay contact arrangement³ (required for D/O only)
								Alarm Aux1 Aux2
		1						N.O. N.O. N.O.
		2						N.O. N.O. N.C.
		3						N.O. N.C. N.O.
		4						N.O. N.C. N.C.
		5						N.C. N.O. N.O.
		6						N.C. N.O. N.C.
		7						N.C. N.C. N.O.
		8						N.C. N.C. N.C.
								100P 100 Ohm platinum RTD
								10C 10 Ohm copper RTD
								100N 100 Ohm nickel RTD
								120N 120 Ohm nickel RTD
								HI 80 – 300 VDC/65 – 265 VAC control power
								LO 20 – 60 VDC/20 – 48 VAC control power

Step 1. Select your existing 269^{Plus} Drawout order code

269 - D/O - - -

Step 2. Configure your 369 Drawout upgrade

Power Supply **HI - 50-300 VDC/40-265 VAC Control Power**

RTD Option **R - 12 RTD inputs**

Metering **M - Metering package included**

Harsh Environment Option

Diagnostics **E - Enhanced diagnostics / faceplate**

MOD: **MOD 145**



Relays and Meters

Protection & Control

339 Motor Protection System

Intuitive protection and advanced communications for AC motors

Key Benefits

- Enhanced Thermal Model including RTD and current unbalance biasing providing complete motor protection
- Detailed Motor Health Report providing critical motor data simplifying motor analysis
- Increase process uptime by trouble shooting problems faster with time stamped event reports, waveform capture, motor start and motor trending
- Increase security and reduce potential system risks with the Security Audit Trail capturing setting and command changes
- Powerful communication capabilities allowing seamless integration into most communication architectures
- Easy access to information via multiple communication network options including USB, Serial, Fiber & copper Ethernet
- Eliminate FT switches, needed for testing with the unique draw-out construction
- Reduced wiring with support for remote RTDs
- Reduce setup and configuration time with the Simplified Motor Setup screen
- Customized motor overload curve using Flex curves

Applications

- Small to Medium sized Medium Voltage AC Motors
- Protection of pumps, conveyors, fans, compressors, etc.
- Applications requiring fast and secure communications
- Harsh environments requiring protection against corrosive chemicals and humid environments

Features

Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Phase and ground TOC and IOC
- Start supervision and inhibit
- Mechanical Jam
- Current Unbalance
- Overvoltage
- Undervoltage
- Under/Over Frequency
- Voltage Phase Reversal
- Acceleration Time
- Undercurrent / Underpower
- Starts per Hour

Enervista™ Software

- Enervista™ Software- an industry-leading suite of software tools that simplifies every aspect of working with Multilin devices.
- Simplified motor setting configurator



Features (continued)

Metering & Monitoring

- Current Metering
- RTD Temperature
- Voltage Metering
- Power & Energy Metering
- Frequency Metering
- Event Recorder: 256 events with 1ms time stamping
- Oscillography with 32 samples per cycle and digital states
- IRIG-B clock synchronization
- Motor health diagnostics
- Security audit trail

User Interface

- 4X20 character LCD display
- Control panel with 12 LED indicators
- Front USB and rear serial & Ethernet ports
- Multiple Protocols:
 - IEC 61850
 - IEC 61850 GOOSE
 - MODBUS TCP/IP, MODBUS RTU,
 - DNP 3.0, IEC 60870-5-104, IEC 60870-5-103



Relays and Meters

Protection & Control

339 Motor Protection System

Intuitive protection and advanced communications for AC motors

Section 22

Ordering

	339	E	**	**	**	E	S	N	*	**	D	*	Description
Base Unit	339												Base Unit
Language		E											English
Phase Currents*		P1											1A three phase current inputs
		P5											5A three phase current inputs
339 Ground Currents*			G1										1A ground current input
			G5										5A ground current input
Power Supply				L									24 - 48 Vdc
				H									110 - 250 V dc/110 - 230 Vac
Faceplate					E								Standard faceplate (LCD, full menu, actual values and setpoints) with 10 Inputs, 7 Outputs (2 Form A, 5 Form C)
339 Current Protection						S							Standard Configuration - 14, 37, 46, 48, 49, 50P(1), 50G(1), 50M, 50L, 66, 86, 50BF(1), 50N(1), 51G(1)
339 Other Options									N				No Selection
									M				Voltage Metering
									P				Voltage Protection - 27P(2), 47(1), VTFF(1), 59P(2), 81O(2), 81U(2), 59_2(1)
Communications									S	N			Standard :Front USB, Rear RS485 : Modbus RTU, DNP3.0, IEC 60870-5-103
									1	E			Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104
									2	E			Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850 GOOSE
									3	E			Standard + Ethernet (Copper & Fiber - MTRJ) MODBUS TCP/IP, DNP3.0, IEC 60870-5-104, IEC 61850
Case Design											D		Draw-out
Harsh Environment												N	None
												H	Harsh Environment Conformal Coating

Ordering Notes: 1) G1/G5 and S1/S5 must match corresponding P1/P5 - there cannot be 5A and 1A mixing



Relays and Meters

Protection & Control

269^{Plus} Motor Protection System

Integrated protection and control for medium sized AC motors

Section 22

Key Benefits

- Enhanced Thermal Model including current unbalance and RTD biasing
- Temperature monitoring with programmable RTD inputs for Stator, Bearing and Ambient temperature protection
- Reduce troubleshooting time and maintenance costs – motor running and learned data, last trip data
- Simplify testing - Built in simulation features
- Cost Effective Access to information through standard RS485 serial ports using Modbus RTU
- Field upgradable settings and firmware
- Installation flexibility - Remote display and drawout case options

Applications

- Medium size motors

Features

Protection and Control

- Thermal model biased with RTD and negative sequence current feedback
- Stator winding & bearing overtemperature
- Motor multiple starts
- 8 standard overload curves
- User defined overload FlexCurve™
- Undercurrent for load loss
- Locked rotor
- Rapid trip/mechanical jam
- Unbalance/single phasing
- Short circuit
- Ground fault
- Phase reversal (meter option)
- Variable lock-out time
- Latched main trip relay, alarm relay
- 2 auxiliary relays
- Emergency restart capability
- Pre-trip alarm warnings

Monitoring and Metering

- Current & Thermal Capacity metering
- Data Logger
- Learned & Statistical Data
- Optional voltage, power metering

Accessories for the 269^{Plus}

Multinet™ Serial to Ethernet converter	Multinet-FE
Viewpoint Monitoring	VP-1
D485 Devicenet converter	D485-C
P485 Profibus converter	P485-C

Visit www.GEMultilin.com/269Plus to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a 269^{Plus} online



Features (continued)

Inputs and Outputs

- 12 RTDs, programmable
- 5 factory programmed digital inputs
- 4 output relays
- 1 programmable analog output

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the 269^{Plus} into new or existing monitoring and control systems

Ordering

269 ^{Plus}	*	*	*	*	*	*	269 ^{Plus} motor management relay™
269 ^{Plus}	SV						Standard version
	D/O						Drawout version
	1						Phase CT ¹ Ground CT (required for D/O only)
	2						:5 2000:1
	3						:5 :5
	4						:1 2000:1
							:1 :5
							Relay fail safe code ² (required for D/O only)
	1						Trip Alarm Aux1 Aux2
	2						FS NFS NFS FS
	3						NFS FS NFS FS
	4						FS FS NFS FS
	5						NFS NFS FS FS
	6						FS NFS FS FS
	7						NFS FS FS FS
	8						FS FS NFS FS
							Relay contact arrangement ³ (required for D/O only)
	1						Alarm Aux1 Aux2
	2						N.O. N.O. N.O.
	3						N.O. N.O. N.O.
	4						N.O. N.C. N.O.
	5						N.C. N.O. N.O.
	6						N.C. N.O. N.C.
	7						N.C. N.C. N.O.
	8						N.C. N.C. N.C.
							100P 100 Ohm platinum RTD
							10C 10 Ohm copper RTD
							100N 100 Ohm nickel RTD
							120N 120 Ohm nickel RTD
							HI 80 ~ 300 VDC/65 ~ 265 VAC control power
							LO 20 ~ 60 VDC/20 ~ 48 VAC control power



- Enhanced Motor Overload Protection with Thermal Modeling
- Simple configuration and system monitoring using EnerVista™ 239 Setup software
- Reduced cost and commissioning time with Protection, Monitoring, and Control in a single device
- Scalable protection with optional RTD inputs and advanced Motor Protection elements
- Simplified testing and commissioning with built in simulation features
- Field upgradable firmware and relay options
- Easy access to system and relay information using Modbus RTU

Applications

- Multiple groups of protection settings allows flexible protection for flexible systems
- Small to Medium sized three phase AC induction and synchronous motors
- Pumps, conveyors, compressors, fans, etc.

Features

Protection and Control

- Thermal Overload (15 selectable curves) - Trip and alarm, immediate current overload alarm
- Phase short circuit
- Mechanical jam
- Thermal memory lockout
- Single-Phasing /Current unbalance
- Ground fault - trip and alarm
- Overtemperature: via thermistor or optional RTD inputs
- Undercurrent
- Breaker Failure
- Trip/alarm/auxiliary/service outputs
- Multi-speed motor protection
- Motor start supervision

Communications

- RS485 Serial Communications
- Modbus RTU protocol

Monitoring and Metering

- Status/current/temperature display
- Fault diagnosis
- Trending
- Trip record, last 5
- Process control
- Optional analog output



Features (continued)

User Interface

- 40 Character backlit display for easy viewing of settings and actual values
- 6 Motor and relay status LED's
- Multiple programming keys to allow easy access to system values and relay settings

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the 239 into new or existing monitoring and control systems

Ordering

239	*	*	*	
239				Basic unit
	RTD			3 RTDs: stator/bearing; programmable type: platinum, nickel, copper
		AN		Single isolated, analog output: 0 - 1, 0 - 20, 4 - 20 mA
				Programmable output parameters: thermal capacity, % full load, phase current, RTD1, RTD2, RTD3 temperature
			H	Harsh environment conformal coating

Modifications

- | | |
|---------|--|
| MOD601: | 240 VAC switch inputs – allows the use of external 240 VAC supply to power switch inputs |
| MOD602: | 24 – 48 VDC switch inputs – allows the use of external 24 – 48 VDC supply to power switch inputs |
| MOD603: | ESD relay – converts AUX 2 relay into an emergency shutdown relay |
| MOD605: | Removable rear terminals – allows terminals 13 – 58 to be unplugged from the 239 |
| MOD613: | 240 VAC VT input |
| MOD614: | VT primary setpoint up to 7200 V and variable overload curve setting |
| MOD615: | VT primary setpoint up to 7200 V and backspin timer |
| MOD616: | 239 with remote display |

Accessories for the 239

Viewpoint Monitoring	VP-1
50:0.025 Ground CT	HGF3
Multinet™ Serial to Ethernet converter	Multinet-FE
2.25" Shallow Mount Collar	1009-0068

Visit www.GEMultilin.com/239 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an 239 online

Relays and Meters Protection & Control

Section 22

MM300™ Motor Management System

Integrated automation and protection for low voltage motors

Key Benefits

- Full-featured protection for low voltage AC motors
- Advanced automation capabilities for providing customized protection and integrated process control
- Advanced FlexLogic™ reduces requirement for local PLCs
- Reduced installation space requirements through integration of multiple devices including protection, control functions, pushbuttons, status LEDs and communication interfaces
- Application flexibility with multiple I/O options and programmable logic options (FlexLogic™)
- Enhanced troubleshooting tools including sequence of event records and waveform capture
- Powerful communications including Serial, Ethernet, Profibus, and DeviceNet protocols
- Small form factor and remote display options designed to fit in MCC buckets



Applications

- Low Voltage three phase AC motors
- MCC or stand alone panel mount applications
- Reversing and Reduced Voltage applications
- Motor applications requiring advanced Automation or Control such as conveyor systems or well recovery pumps
- IEC or NEMA class motors

Features

Protection and Control

- Enhanced Thermal Modeling
- Mechanical Jam / Stalled Rotor
- Undercurrent
- Underpower
- Acceleration Time
- Current Unbalance
- Ground Fault
- Sensitive Ground Fault
- Phase Overvoltage / Undervoltage
- Auxiliary Undervoltage
- Phase Reversal
- VT Fuse Failure
- Thermistor
- RTD Overtemperature

Automation

- Programmable FlexLogic™ option
- Starter Control
- Process Interlocks
- Programmable inputs and outputs
- Undervoltage Auto-restart

Monitoring and Metering

- Metering - current, voltage, power, energy, frequency, RTD, Thermistor
- Oscillography - analog values at 32 samples/cycle and digital states

Features (continued)

- Event Recorder - Up to 256 time tagged events with 1ms resolution
- Advanced device health diagnostics

Communications

- Networking Interfaces - Two Wire RS485, RJ45 Ethernet
- Multiple Protocols (Modbus RTU , Modbus TCP/IP, Profibus, Devicenet)
- Programming Ports - USB, RS485
- Network Time Protocol (when ordered with Ethernet)

User Interface

- Control panel with 12 status LEDs, Motor Control and function keys
- Color HMI Display featuring a full color graphical display, Motor and system status LEDs, USB programming port and motor control keys.

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date



Relays and Meters

Protection & Control

MM2 Motor Protection System

Integrated process, control, and protection for low voltage motors

Key Benefits

- Full featured protection for low voltage AC motors
- Advanced automation capabilities providing customized protection and integrated automation control
- Cost effective solution - Low cost modular design
- Small footprint and compact design - With or without display, fits into standard MCC buckets
- Preconfigured logic for all standard motor starter types, EnerVista™ compatible
- Integrated motor control pushbuttons
- Remote monitoring via serial communications, Modbus RTU
- Easy installation and integration - Panel mount option
- Reduced number of devices - Replaces bi-metal overload elements, integrates timers, relays, meters, switches, indicators

Applications

- Motor protection and management system for low voltage AC motors
- Specifically designed for Motor Control Center applications

Features

Protection and Control

- Motor Thermal Model
- Single phase / Current unbalance
- Contactor failure
- Locked/stalled rotor
- Ground fault
- Undervoltage, Overvoltage
- Overtemperature
- Acceleration Trip
- Thermistor Protection
- Starts per Hour / Time Between Starts
- Undercurrent and underpower
- Configurable motor start controller
- Undervoltage auto restart

Monitoring and Metering

- Motor operational parameters and historical data
- Process data
- Phase and ground current, power, energy, voltage
- Status of relay inputs
- Trip record and pre-trip values
- Motor statistical information

User Interface

- 40 Character LCD display
- Front Panel control push buttons and programming keypad
- 11 Motor and Relay Status LED's
- RS485 ModBus®, 1200 - 19,200 bps

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the MM2 into new or existing monitoring and control systems



Section 22

Motor Protection

	Standard	Option 1 Adds	Option 2 Adds
Protection and Control	Overload (49/51) phase unbalance (46) welded/open contactor	Undervoltage auto restart diagnostics	Ground fault (50G/51G), rapid trip locked/stalled rotor (48) overtemperature thermistor (49) undercurrent/underpower (37) overvoltage (59)/undervoltage (27)
Inputs	4 Control 2 Programmable	8 Programmable 1 Analog	2 Control Thermistor input
			Single-phase voltage input for kW and kWh
Relays	Contactors control (A)	Auxiliary 1 and 2	Contactors control (B)
Mounting Configurations	Chassis mount	Chassis mount panel mount with display available when both options are ordered	Chassis mount

Ordering

MM2	*	*	*	*	
MM2					Basic unit
	PD				Panel mount with display *
	C				Chassis mount (black box)
		1			Option 1 Process control, 10 process inputs, undervoltage auto restart, diagnostics
			2		Option 2 Enhanced protection, power (kW), thermistor, 2nd contactor control, and 2 process inputs
				120	Control voltage 120 VAC
				240	Control voltage 240 VAC

Note: *Only Available when both options are ordered.

Modifications

MOD601:	240 VAC switch inputs – allows the use of external 240 VAC supply to power switch inputs
MOD602:	24 – 48 VDC switch inputs – allows the use of external 24 – 48 VDC supply to power switch inputs
MOD603:	ESD relay – converts AUX 2 relay into an emergency shutdown relay
MOD605:	Removable rear terminals – allows terminals 13 – 58 to be unplugged from the MM2
MOD610:	Conformal coating
MOD613:	240 VAC VT input
MOD614:	VT primary setpoint up to 7200 V and variable overload curve setting
MOD615:	VT primary setpoint up to 7200 V and backspin timer
MOD616:	MM2 with remote display

Accessories for the MM2

Viewpoint Monitoring	VP-1
50:0.025 Ground CT	HGF3
5 A Phase CT	
1 A Phase CT	

Visit www.GEMultilin.com/MM2 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an MM2 online



Relays and Meters

Protection & Control

SPM Synchronous Motor Protection System

Starting protection, synchronization and control for synchronous motors

Key Benefits

- Complete asset monitoring - Field Winding temperature and statistical data
- Improve uptime of auxiliary equipment - Through I/O monitoring
- Access to information - RS485 Communications port and Modbus RTU Protocol

Applications

- Starting, synchronizing and protection of collector-ring or brushless-type synchronous motors

Features

Protection and Control

- Field application
- DC field current loss, exciter current loss, DC field voltage check
- PF regulation, reluctance torque synchronizing
- Protects motor during start up and in the event of asynchronous operation
- Squirrel cage winding overheating protection
- Automatic phase rotation correction
- Auto-loading and incomplete sequence
- Regulator tuning mode
- True RMS metering with DFT filtering
- Optional power factor regulator with adjustable settings
- Power factor & pull out protection (Optional)
- Speed dependent squirrel cage overload protection
- Motor restart protection

Monitoring and Metering

- Motor power factor
- DC excitor amps and voltage
- AC Current
- Exciter field resistance
- Motor run time
- Record of trips



Features (continued)

User Interface

- 40 Character backlit display for easy viewing of settings and actual values
- Function keys allow programming of settings and viewing of measured values

Communications

- RS485 Serial Communications
- Modbus RTU protocol
- Optional Ethernet communications using Multinet™ Serial to Ethernet converter

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the SPM into new or existing monitoring and control systems

Ordering

SPM	*	*
SPM	PF	H
<p>SPM: standard starting and protection relay with VDN board PF: power factor regulation option used on motors with proportional SCR exciter. (not recommended for brushless applications) H: Harsh environment conformal coating</p>		

Accessories for the SPM

200A DCCT & Calibration Module	PG2SPM
400A DCCT & Calibration Module	PG4SPM
μSPM Retrofit Package	MPSPM
Viewpoint Monitoring	VP-1

Visit www.GEMultilin.com/SPM to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an SPM online



Relays and Meters Protection & Control Specialized Protection and Control

Section 22

C60

[page 22-111](#)

Breaker Monitoring and Control for Substation Automation

The C60 Breaker Protection System provides a complete integrated package for the protection, control, and monitoring of circuit breakers. The C60 supports multi-breaker busbar configurations including breaker-and-a-half and ring bus arrangements.

C30

[page 22-113](#)

Substation hardened programmable logic controller

The C30 Controller System is a programmable logic controller for performing substation or bay automation that can also be used for expanding the I/O capability of protection devices and replacing Sequence of Event (SOE) recorders. The C30 provides fast deterministic execution of programmable logic with I/O capabilities far above an average protection relay.

N60

[page 22-115](#)

Load shedding, remedial action and special protection schemes

The N60 Network Stability and Synchrophasor Measurement System is a flexible device intended for the development of load shedding, remedial action, special protection schemes and wide area monitoring and control.

C70

[page 22-117](#)

Capacitor bank protection and control system

The C70 is an integrated protection, control, and monitoring device for shunt capacitor banks. The C70 provides both the bank and system protection schemes for shunt capacitor bank protection.

C90^{Plus}

[page 22-119](#)

Automation Control System

The C90^{Plus} is a powerful automation controller that eliminates the need for several external devices, such as substation programmable logic controllers and disturbance recorders. Highly customizable and scalable, C90Plus is designed for blackout and emergency events in transmission and industrial power systems.

HardFiber

[page 22-121](#)

IEC 61850 Process Bus Solutions

The HardFiber System is a KEMA tested IEC 61850 Process Bus Solution that allows the mapping of measurements made in the switchyard to protection relays located in the control house using secure communications.

MIV II

[page 22-123](#)

Three-phase and ground voltage protection relay

The MIV II, a member of the M II Family of protection relays provides voltage and frequency protection for a wide range of applications.

MIN II

[page 22-124](#)

Complete numerical ground directional protection

The MIN II, a member of the M II Family of protection relays provides directional protection on distributed networks.

RRTD

[page 22-125](#)

Remote temperature monitoring of RTD 's

The remote RTD Module provides additional RTD temperature metering capabilities for the 369 Motor Protection System.

DDFR

[page 22-126](#)

Distributed Digital Fault Recorder

The DDFR™ is a Power System Fault Recorder that collects, archives and manages Disturbance and Fault information that is recorded by microprocessor based protective relays distributed throughout your local power system.



Relays and Meters

Protection & Control

C60 Breaker Protection System

Breaker Monitoring and Control for Substation and Industrial Automation

Section 22

Key Benefits

- Complete breaker control, protection, monitoring and integration in a single platform
- Advanced automation capabilities for providing customized protection and control solutions
- Modular hardware architecture allows for flexibility in device configurations to cover most breaker applications
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 micro-second time synchronization via LAN with IEEE® 1588 support
- Reduced wiring through the use of high-speed peer-to-peer communication for accepting trip and close commands from other relays
- Embedded IEC® 61850 protocol with no external communications hardware required
- Simplified system integration with communications supporting serial, Ethernet and multiple protocols
- Increase network availability by reducing failover time to zero through IEC 62439-3 "PRP" support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- Advanced fault and disturbance recording, including internal relay operating signals thus eliminating the need for external recording devices
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Stand-alone breaker monitoring and control
- Multiple breaker configuration control including breaker-and-a-half and ring bus
- Automatic bus transfer scheme using a single device
- As part of a distributed bay controller

Features

Protection and Control

- Breaker failure
- Synchronism check
- Autoreclose and open pole detector
- Phase, neutral and auxiliary overvoltage
- Neutral and auxiliary overvoltage
- Thermal overload, phase, ground and neutral overcurrent
- Sensitive directional power
- Dual breaker control



Features

Communication

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, EGD, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip and I/O extension applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Fault Locator
- Setting for security audit trails for tracking changes to the C60 configuration

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the C60 into new or existing monitoring and control systems



Relays and Meters

Protection & Control

C60 Breaker Protection System

Section 22

Breaker Monitoring and Control for Substation and Industrial Automation

Ordering

C60 - * ** - H * * - F ** - H ** - M ** - P ** - U ** - W **										For Full Sized Horizontal Mount
C60 - * ** - V F * - F ** - H ** - M ** - P ** - U ** - W **										For Reduced Size Vertical Mount
Base Unit	C60	I								Base Unit
CPU		E								RS485 + RS485 (IEC 61850 option not available)
		G								RS485 + Multimode ST 10BaseF
		H								RS485 + Multimode ST Redundant 10BaseF
		J								RS485 + Multimode ST 100BaseFX
		K								RS485 + Multimode ST Redundant 100BaseFX
		N								RS485 + 10/100BaseT
		T								RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
		U								RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher
		V								RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)		00								No Software Options
		01								Ethernet Global Data
		03								IEC 61850
		04								Ethernet Global Data
		A0								CyberSentry UR Lvl 1. Req UR FW 7.xx or higher
		B0								IEEE 1588. Req UR FW 7.xx or higher
		C0								PRP
		D0								IEEE 1588 + CyberSentry UR. Req UR FW 7.xx or higher
Mount			H							Horizontal (19" rack) - Standard
			A							Horizontal (19" rack) - Harsh Chemical Environment Option
			V							Vertical (3/4 size) - Standard
			B							Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface				K						Enhanced English Front Panel
				L						Enhanced English Front Panel with User-Programmable Pushbuttons
				M						Enhanced French Front Panel
				N						Enhanced French Front Panel with User-Programmable Pushbuttons
				Q						Enhanced Russian Front Panel
				T						Enhanced Russian Front Panel with User-Programmable Pushbuttons
				U						Enhanced Chinese Front Panel
				V						Enhanced Chinese Front Panel with User-Programmable Pushbuttons
				F						Vertical Front Panel with English display
				W						Enhanced Turkish Front Panel
				Y						Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)			H							125 / 250 V AC/DC
			L						RH	125/250 V AC/DC with redundant 125/250 V AC/DC power supply
										24 - 48 V (DC only)
CT/VT DSP					8L		8L			Standard 4CT/4VT w/ enhanced diagnostics
					8M		8M			Sensitive Ground 4CT/4VT w/ enhanced diagnostics
					8N		8N			Standard 8CT w/ enhanced diagnostics
					8R		8R			Sensitive Ground 8CT w/ enhanced diagnostics
IEC 61850 Process Bus Digital I/O						81				8 Port IEC 61850 Process Bus Module
						XX	XX	XX	XX	No module
						4A	4A	4A	4A	4 Solid State (No Monitoring) MOSFET Outputs
						4C	4C	4C	4C	4 Solid State (Current w/ opt Voltage) MOSFET Outputs
						4L	4L	4L	4L	14 Form-A (No Monitoring) Latchable Outputs
						67	67	67	67	8 Form-A (No Monitoring) Outputs
						6C	6C	6C	6C	8 Form-C Outputs
						6D	6D	6D	6D	16 Digital Inputs
						6E	6E	6E	6E	4 Form-C Outputs, 8 Digital Inputs
						6F	6F	6F	6F	8 Fast Form-C Outputs
						6K	6K	6K	6K	4 Form-C & 4 Fast Form-C Outputs
						6L	6L	6L	6L	2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
						6M	6M	6M	6M	2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
						6N	6N	6N	6N	4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
						6P	6P	6P	6P	6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
						6R	6R	6R	6R	2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
						6S	6S	6S	6S	2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
						6T	6T	6T	6T	4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
						6U	6U	6U	6U	6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
						6V	6V	6V	6V	2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
Transducer I/O					5A	5A	5A	5A	5A	4 dcmA Inputs, 4 dcmA Outputs
					5C	5C	5C	5C	5C	8 RTD Inputs
					5D	5D	5D	5D	5D	4 RTD Inputs, 4 dcmA Outputs
					5E	5E	5E	5E	5E	4 dcmA Inputs, 4 RTD Inputs
					5F	5F	5F	5F	5F	8 dcmA Inputs
Inter-Relay Communications									7A	820 nm, multimode, LED, 1 Channel
									7B	1300 nm, multimode, LED, 1 Channel
									7C	1300 nm, singlemode, ELED, 1 Channel
									7H	820 nm, multimode, LED, 2 Channels
									7I	1300 nm, multimode, LED, 2 Channels
									7J	1300 nm, singlemode, ELED, 2 Channels
									7S	G.703, 2 Channels
									7W	RS422, 2 Channels
									77	IEEE C37.94, 820 nm, multimode, LED, 2 Channel
									2B	IEEE C37.94, 1300nm, singlemode, ELED, 2 channel

Ordering Note: 1. To view all the options available for C60, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=C60>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Accessories for the C60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-A2-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



Relays and Meters Protection & Control C30 Controller System

Substation Hardened Programmable Logic Controller

Section 22

Key Benefits

- Powerful and deterministic programmable logic suitable for creating most customized automated substation control solutions
- Modular hardware architecture allowing for flexibility in the I/O configuration to support most bay management applications
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with advanced 1 microsecond time synchronization via LAN with IEEE® 1588 support
- Reduced bay or station wiring through the use of high-speed peer-to-peer communication for sending and accepting control commands from other relays
- Simplified system integration and access to information through the use of multiple communication options and protocols not found in industrial grade PLCs
- Embedded IEC® 61850 protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Robust network security enabling Critical Infrastructure Protection through user command logging, and dual permission access control
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Bay control and substation automation
- Programmable logic control
- UR I/O expansion
- Sequence of Events (SOE) recorder replacement

Features

Protection and Control

- Programmable logic, timers, counters
- Distributed logic, remote I/O expansion
- User-definable protection elements
- Up to 96 digital inputs and 64 digital outputs
- Transducer I/Os (RTD, DCmA)

Communication

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94
- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, EGD, PRP
- Direct I/O: secure, high-speed exchange of data between URs for direct transfer trip and I/O extension applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports



Features (continued)

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to the C30 configuration

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the C30 into new or existing monitoring and control systems



Relays and Meters Protection & Control C30 Controller System

Substation Hardened Programmable Logic Controller

Section 22

Ordering

	C30	-	*	**	-	H	*	*	-	F**	-	H**	-	M**	-	P**	-	U**	-	W**	For Full Sized Horizontal Mount
C30 CPU	I																				Base Unit RS485 + RS485 RS485 + Multimode ST 10BaseF RS485 + Multimode ST Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 BaseT RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)	E G H J K N T U V																				No Software Options Ethernet Global Data IEC 61850 Ethernet Global Data (EGD) + IEC 61850 CyberSentry UR Lvl 1. Req UR FW 7.xx or higher IEEE 1588. Req UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry UR. Req UR FW 7.xx or higher
Mount/Coating						H A V B															Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option Vertical (3/4 size) - Standard Vertical (3/4 size) - Harsh Chemical Environment Option
User Interface							K L M N Q T U V F W Y														Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply (see note 2 below)						H H L															125 / 250 V AC/DC 125/250 V AC/DC with redundant 125/250 V AC/DC power supply 24 - 48 V (DC only) 8 Port IEC 61850 Process Bus Module
IEC 61850 Process Bus Digital I/O										81				XX	XX	XX	XX	XX	XX	XX	No module 4 Solid State (No Monitoring) MOSFET Outputs 4 Solid State (Voltage w/opt Current) MOSFET Outputs 4 Solid State (Current w/opt Voltage) MOSFET Outputs 16 Digital Inputs with Auto-Burnish 14 Form-A (No Monitoring) Latchable Outputs 8 Form-A (No Monitoring) Outputs 2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs 8 Form-C Outputs 16 Digital Inputs 4 Form-C Outputs, 8 Digital Inputs 8 Fast Form-C Outputs 4 Form-A (Voltage w/ opt Current) Outputs, 8 Digital Inputs 6 Form-A (Voltage w/ opt Current) Outputs, 4 Digital Inputs 4 Form-C & 4 Fast Form-C Outputs 2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs 6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs 2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs 2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs 4 Form-A (No Monitoring) Outputs, 8 Digital Inputs 6 Form-A (No Monitoring) Outputs, 4 Digital Inputs 2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
Transducer I/O														5A	5A	5A	5A	5A	5A	5A	4 dcmA Inputs, 4 dcmA Outputs 8 RTD Inputs 4 RTD Inputs, 4 dcmA Outputs 4 dcmA Inputs, 4 RTD Inputs 8 dcmA Inputs
Inter-Relay Communications																					2A C37.94SM, 1300nm singlemode, ELED, 1 channel singlemode 2B C37.94SM, 1300nm singlemode, ELED, 2 channel singlemode 7A 820 nm, multimode, LED, 1 Channel 7B 1300 nm, multimode, LED, 1 Channel 7C 1300 nm, singlemode, ELED, 1 Channel 7H 820 nm, multimode, LED, 2 Channels 7I 1300 nm, multimode, LED, 2 Channels 7J 1300 nm, singlemode, ELED, 2 Channels 7R G.703, 1 Channel 7S G.703, 2 Channels 7T RS422, 1 Channel 7W RS422, 2 Channels 76 IEEE C37.94, 820 nm, multimode, LED, 1 Channel 77 IEEE C37.94, 820 nm, multimode, LED, 2 Channels

Ordering Note: 1. To view all the options available for C30, please visit GE's On-Line Store at <http://store.gedigitalenergy.com/viewprod.asp?model=C30>
2. Redundant power supply only available in horizontal unit. If redundant is chosen, must be same type. Maximum 2 per chassis

Accessories for the C30

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A2-A6-F1

Accessories for the C30 (continued)

Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850



N60 Network Stability and Synchrophasor Measurement

Synchrophasors, Load Shedding, Remedial Action, Special Protection Schemes

Key Benefits

- Scalable synchrophasor measurements with up to 4 PMUs per IED, reducing synchrophasor cost by up to 75%
- Real-time access to remote analog data, providing for advanced wide area applications and enhanced system security
- Exceeds the latest IEEE® C37.118 standard for PMU measurement devices with a TVE of less than 1%, protection and metering class synchrophasors and multi-cast IEC® 61850-90-5 support
- Uninterrupted synchrophasor measurements during fault and disturbances, providing highly reliable capture of data for critical control functions and post-mortem analysis
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with 1 microsecond time synchronization via LAN with IEEE 1588 support
- Simplified system integration with direct connection to Jungle-MUX SONET, TN1U SDH and TN1Ue SDH networks
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Complete IEC 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Decrease blackouts by identifying network instabilities and taking fast preventative action
- Increase utilization of existing investments by identifying power transfer capability on existing lines
- Compliments existing protection and control by sharing power and utilization information with existing systems to enhance system security
- Facilitate contingency planning through continuous synchrophasor data collection and postmortem analysis
- Provides enhanced state estimation for SCADA to optimize system-wide load shedding and remedial action schemes
- Mitigate system critical conditions such as power system dampening and loss of synchronism through the use of enhanced automated control to reduce outages

Features

Protection and Control

- Underfrequency, overfrequency, and rate of change of frequency (df/dt)
- Out-of-step tripping and power swing blocking
- Thermal overload and phase instantaneous overcurrent
- Synchrocheck
- Overvoltage, undervoltage
- FlexMath for performing automated network control for applications such as automatic load shedding, power balancing and remedial action schemes



Features (continued)

Communication

- Synchrophasor streaming over Ethernet with up to four PDCs simultaneously and rates from 1 to 120 phasors/sec
- Direct I/O for exchange of binary and analog data with N60 located locally or remotely
- IEC 61850 enabled including 61850-90-5 support for synchrophasor data exchange capabilities
- N60-to-N60 communications using direct fiber or through multiplexers using G.703, RS422, or C37.94 interfaces

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Synchrophasor recording: 12MB of memory with multiple recording and triggering options, 46 configurable channels
- Metering: current, voltage, power, energy frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Setting for security audit trails for tracking changes to N60 configurations

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the N60 into new or existing monitoring and control systems



N60 Network Stability and Synchrophasor Measurement

Synchrophasors, Load Shedding, Remedial Action, Special Protection Schemes

Ordering

	N60-	*	**	H	*	F**	H**	M**	P**	U**	W/X**	For Full Sized Horizontal Mount
Base Unit	N60											Base Unit
CPU	E G H J K N T U V											RS485 & RS485 (IEC 61850 option not available) RS485 + Multimode ST 10BaseF RS485 + Multimode ST Redundant 10BaseF RS485 + Multimode ST 100BaseFX RS485 + Multimode ST Redundant 100BaseFX RS485 + 10/100 BaseT RS485 + three Multimode SFP LC 100BaseFX, Req FW v7xx or higher RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (see note 1 below)	00 03 06 07 14 15 16 17 A0 B0 C0 D0											No Software Options IEC 61850 1 Phasor Measurement Units (PMU) 1 Phasor Measurement Units (PMU) + IEC 61850 2 Phasor Measurement Units (PMU) 2 Phasor Measurement Units (PMU) + IEC 61850 4 Phasor Measurement Units (PMU) 4 Phasor Measurement Units (PMU) + IEC 61850 CyberSentry UR Lvl 1, Req UR FW 7.xx or higher IEEE 1588, Req UR FW 7.xx or higher PRP IEEE 1588 + CyberSentry, Req UR FW 7.xx or higher
Mount				H A								Horizontal (19" rack) - Standard Horizontal (19" rack) - Harsh Chemical Environment Option
User Interface					K L M N Q T U V W Y							Enhanced English Front Panel Enhanced English Front Panel with User-Programmable Pushbuttons Enhanced French Front Panel Enhanced French Front Panel with User-Programmable Pushbuttons Enhanced Russian Front Panel Enhanced Russian Front Panel with User-Programmable Pushbuttons Enhanced Chinese Front Panel Enhanced Chinese Front Panel with User-Programmable Pushbuttons Vertical Front Panel with English display Enhanced Turkish Front Panel Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply					H L							125/250 V AC/DC 24 - 48 V DC only
CT/VT DSP	Required for PMU Option					8L		8L				Standard 4CT/4VT w/ enhanced diagnostics
IEC 61850 Process Bus	Required for PMU Option					8N		8N				Standard 8CT w/ enhanced diagnostics
Digital I/O						XX	XX	XX	XX	XX	XX	8 Port IEC 61850 Process Bus Module
						67	67	67	67	67	67	No Module
						6A	6A	6A	6A	6A	6A	8 Form-A (No Monitoring) Outputs
						6B	6B	6B	6B	6B	6B	2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs
						6C	6C	6C	6C	6C	6C	2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs
						6D	6D	6D	6D	6D	6D	8 Form-C Outputs
						6E	6E	6E	6E	6E	6E	16 Digital Inputs
						6F	6F	6F	6F	6F	6F	4 Form-C Outputs, 8 Digital Inputs
						6L	6L	6L	6L	6L	6L	8 Fast Form-C Outputs
						6N	6N	6N	6N	6N	6N	2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
						6P	6P	6P	6P	6P	6P	4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
						6R	6R	6R	6R	6R	6R	6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
						6S	6S	6S	6S	6S	6S	2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
						6T	6T	6T	6T	6T	6T	2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
						6U	6U	6U	6U	6U	6U	4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
						6V	6V	6V	6V	6V	6V	6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
						4D	4D	4D	4D	4D	4D	2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
						4L	4L	4L	4L	4L	4L	16 Digital Inputs with Auto-Burnish
Transducer I/O						5A	5A	5A	5A	5A	5A	14 Form-A (No Monitoring) Latchable Outputs
						5C	5C	5C	5C	5C	5C	4 dcmA Inputs, 4 dcmA Outputs
						5F	5F	5F	5F	5F	5F	8 RTD Inputs
Inter-Relay Communications												8 RTD Inputs
												1300 nm, singlemode, ELED, 1 channel
												820 nm, multimode, LED, 2 Channels
												1300 nm, multimode, LED, 2 Channels
												1300 nm, singlemode, ELED, 2 Channels
												Channel 1 - RS422, Channel 2 - 1300 nm, multimode, LED
												G.703, 1 Channel
												G.703, 2 Channels
												RS422, 1 Channel
												RS422, 2 Channels, Single Clock
												1550 nm, singlemode, LASER, 2 Channels
												IEEE C37.94, 82 nm, multimode, LED, 1 Channel
												IEEE C37.94, 820 nm, multimode, LED, 2 Channel
												C37.94SM, 1300 nm singlemode, ELED, 1 Channel singlemode
												C37.94SM, 1300 nm singlemode, ELED, 2 Channel singlemode
												RS422, 2 Channels, Dual Clock

Ordering Notes: 1. To view all the options available for N60, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=N60>

Accessories for the N60

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850

Visit www.GEMultilin.com/N60 to:

- View guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a N60 online
- View the UR Family brochure



Relays and Meters

Protection & Control

C70 Capacitor Bank Protection System

Capacitor Bank Protection & Control

Key Benefits

- Protect capacitor banks in a variety of configurations with sensitive current and voltage balance protection functions
- Adaptive compensation techniques truly compensate for the inherent bank unbalance, providing sensitive protection
- Custom programmable logics for advanced shunt capacitor bank controls
- Flexible automatic voltage regulation of shunt capacitor banks along with control supervision
- Three independent fiber or copper Ethernet ports for simultaneous/ dedicated network connections with 1 microsecond time synchronization via LAN with IEEE® 1588 support
- Reduced relay-to-relay wiring and associated installation costs through high-speed inter-relay communications
- Embedded IEC 61850® protocol
- Increase network availability by reducing failover time to zero through IEC 62439-3 “PRP” support
- CyberSentry™ provides high-end cyber security aligned to industry standards and services (NERC® CIP, AAA, Radius, RBAC, Syslog)
- Complete IEC® 61850 Process Bus solution provides resource optimization and minimizes total P&C life cycle costs

Applications

- Protection, control, monitoring and automation of shunt capacitor banks at different voltage levels
- Suitable for protecting multiple capacitor banks
- Sensitive protection for grounded and ungrounded single and parallel capacitor banks and banks with taps, for a variety of capacitor bank configurations
- Capacitor bank-based automatic voltage regulator (AVR) and capacitor control supervision

Features

Protection and Control

- Voltage differential protection and compensated bank neutral voltage unbalance
- Phase current unbalance and neutral current unbalance protection, phase, ground and neutral overcurrent, thermal overload, phase and negative sequence directional overcurrent, and broken conductor
- Bank phase and negative sequence overvoltage
- User-programmable logics for custom schemes
- AVR for switching capacitor banks based on voltage, power factor and reactive power
- Time and date function allowing capacitor bank switching, based on time of day, week and seasons
- Capacitor control supervision block for processing commands from SCADA, remote communication and local control through front panel HMI

Communication

- Networking interfaces: up to three Ethernet ports 100Mb fiber or copper, RS485, RS232, RS422, G.703, C37.94



Features (continued)

- Multiple protocols: IEC 61850, DNP 3.0 and Modbus® serial/TCP, IEEE 1588, IEC 60870-5-104, PRP
- Direct I/O: secure, high-speed exchange of data between Universal Relays (URs) for direct transfer trip and I/O extension applications
- Embedded managed Ethernet switch with four 100 Mbit fiber optic ports and 2 copper ports

IEC 61850 Process Bus Interface

- Robust communications with up to 8 HardFiber Bricks
- Redundant architecture for dependability and security

Monitoring and Metering

- Metering: current, voltage, power, energy, frequency
- Advanced recording capabilities deliver a 1024 event recorder, configurable and extended waveform capture and data logger
- Advanced relay health diagnostics
- Setting for security audit trails for tracking changes to the C70 configuration

EnerVista™ Software

- Graphical Logic Designer and Logic Monitor to simplify designing and testing procedures via EnerVista UR Engineer
- Service and update notification toolset ensures device documents and software are up-to-date via EnerVista Launchpad
- EnerVista Integrator providing easy integration of data in the C70 into new or existing monitoring and control systems



Relays and Meters

Protection & Control

C70 Capacitor Bank Protection System

Capacitor Bank Protection & Control
Ordering

Section 22

C70 - * - 00 - * * - F ** - H ** - M ** - P ** - U ** - W/X **										
Base Unit										Base Unit
CPU	E									RS485 + RS485 (IEC 61850 option not available)
	G									RS485 + Multimode ST 10BaseF
	H									RS485 + Multimode ST Redundant 10BaseF
	J									RS485 + Multimode ST 100BaseFX
	N									RS485 + 10/100 BaseT
	K									RS485 + Multimode ST Redundant 100BaseFX
	T									RS485 + three Multimode SFP LC 100BaseFX. Req FW v7xx or higher
	U									RS485 + two Multimode SFP LC 100BaseFX + one SFP RJ45 100BaseT. Req FW v7xx or higher
	V									RS485 + three SFP RJ45 100BaseT. Req FW v7xx or higher
Software Options (See note below)	00									None
	03									IEC 61850
	12									Enhanced Capacitor Bank Control (AVR, Capacitor Control Supervision, Time & Date)
	13									Enhanced Capacitor Bank Control (AVR, Capacitor Control Supervision, Time & Date) + IEC 61850
	A0									CyberSentry UR Lvl 1. Req UR FW 7.xx or higher
	B0									IEEE 1588. Req UR FW 7.xx or higher
	C0									PRP
	D0									IEEE 1588 + CyberSentry. Req UR FW 7.xx or higher
Mounting / Conformal Coating	H									Horizontal (19" rack) - Standard
	A									Harsh Chemical Environment Option
User Interface			K							Enhanced English Front Panel
			L							Enhanced English Front Panel with User-Programmable Pushbuttons
			M							Enhanced French Front Panel
			N							Enhanced French Front Panel with User-Programmable Pushbuttons
			Q							Enhanced Russian Front Panel
			T							Enhanced Russian Front Panel with User-Programmable Pushbuttons
			U							Enhanced Chinese Front Panel
			V							Enhanced Chinese Front Panel with User-Programmable Pushbuttons
			F							Vertical Front Panel with English display
			W							Enhanced Turkish Front Panel
			Y							Enhanced Turkish Front Panel with User-Programmable Pushbuttons
Power Supply				H						125/250 V AC/DC
				L						24 - 48 V (DC only)
CT/VT DSP					8L		8L		8L	Standard 4CT/4VT w/ enhanced diagnostics
					8N		8N		8N	Standard 8CT w/ enhanced diagnostics
					8V		8V		8V	Standard 8VT w/ enhanced diagnostics
IEC 61850 Process Bus						81				8 Port IEC 61850 Process Bus Module
Digital I/O						XX	XX	XX	XX	No Module
						6A	6A	6A	6A	2 Form-A (Voltage w/ opt Current) & 2 Form-C Outputs, 8 Digital Inputs
						6B	6B	6B	6B	2 Form-A (Voltage w/ opt Current) & 4 Form-C Outputs, 4 Digital Inputs
						6C	6C	6C	6C	8 Form-C Outputs
						6D	6D	6D	6D	16 Digital Inputs
						6E	6E	6E	6E	4 Form-C Outputs, 8 Digital Inputs
						6F	6F	6F	6F	8 Fast Form-C Outputs
						6G	6G	6G	6G	4 Form-A (Voltage w/ opt Current) Outputs, 8 Digital Inputs
						6H	6H	6H	6H	6 Form-A (Voltage w/ opt Current) Outputs, 4 Digital Inputs
						6K	6K	6K	6K	4 Form-C & 4 Fast Form-C Outputs
						6L	6L	6L	6L	2 Form-A (Current w/ opt Voltage) & 2 Form-C Outputs, 8 Digital Inputs
						6M	6M	6M	6M	2 Form-A (Current w/ opt Voltage) & 4 Form-C Outputs, 4 Digital Inputs
						6N	6N	6N	6N	4 Form-A (Current w/ opt Voltage) Outputs, 8 Digital Inputs
						6P	6P	6P	6P	6 Form-A (Current w/ opt Voltage) Outputs, 4 Digital Inputs
						6R	6R	6R	6R	2 Form-A (No Monitoring) & 2 Form-C Outputs, 8 Digital Inputs
						6S	6S	6S	6S	2 Form-A (No Monitoring) & 4 Form-C Outputs, 4 Digital Inputs
						6T	6T	6T	6T	4 Form-A (No Monitoring) Outputs, 8 Digital Inputs
						6U	6U	6U	6U	6 Form-A (No Monitoring) Outputs, 4 Digital Inputs
						6V	6V	6V	6V	2 Form-A (Cur w/ opt Volt) 1 Form-C Output, 2 Latching Outputs, 8 Digital Inputs
										High Power Supply 6-port managed Ethernet switch
										Low Power Supply 6-port managed Ethernet switch
								2S	2S	4 dcmA Inputs, 4 dcmA Outputs
								2T	2T	820 nm, multimode, LED, 2 Channels
Transducer I/O					5A	5A	5A	5A		1300 nm, multimode, LED, 2 Channels
Inter-Relay Communications									7H	G.703, 2 Channels
									7I	RS422, 2 Channels
									7S	IEEE C37.94, 820 nm, multimode, LED, 2 Channel
									7W	

Ordering Note: To view all the options available for C70, please visit GE's On-Line Store <http://store.gedigitalenergy.com/viewprod.asp?model=C70>

Accessories for the C70

UR Applications I Learning CD	TRCD-URA1-C-S-1
Multilink Ethernet Switch	ML2400-F-HI-HI-A2-A6-F1
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850

Visit www.GEMultilin.com/C70 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a C70 online
- View the UR Family brochure



Key Benefits

- Powerful automation controller eliminates the need for separate substation programmable logic controller
- High-end load shedding with multiple stages of frequency and voltage retains system stability after disturbances
- Fast optimal load shedding executed within 20ms minimizes process outages and costs associated with system downtime
- Intelligently sheds loads to maintain system/process integrity
- Highly customizable and scalable, integrating easily into most industrial plants with new or existing EMS/SCADA
- Customizable annunciator panel capable of handling up to 288 alarms eliminates the need for a separate panel
- High-end fault and disturbance recording eliminates the need for digital fault or disturbance recorders
- Synchronized phasor information according to IEEE® C37.118 standard for detection of system instability
- Increase network availability by reducing failover time to zero through IEC® 62439-3 “PRP” support
- HMI with pre-configured and customizable displays including real-time bay control, metering, fast load shed reports, equipment status, fault and event recording

Applications

- Advanced bay control/monitoring (6 breakers and 30 disconnects)
- Fast, power-balance load shed
- Frequency and voltage load shed
- Substation alarm concentrator, annunciator, and controller
- Advanced automation schemes such as bus transfer
- Stand-alone breaker protection and monitoring

Features

Bay Protection & Control

- Dedicated automation controller with 4000 lines of logic
- Powerful math, control and boolean operators
- 10 stages of under/over frequency protection for load shedding
- 4 stages of rate-of-change-of frequency for load shedding
- 6 stages of undervoltage elements for load shedding
- Dedicated protection logic at 1 msec execution rate
- Dedicated HMI for breaker and disconnect control
- Multi-breaker synchrocheck with single/three pole autoreclosing
- Dual breaker failure protection
- Direct and tele-protection elements using inter-relay communications

Communication

- IEC61850, DNP3, Modbus® RTU, Modbus TCP/IP, IEC 60870-5-104, PRP
- Three independently configurable IP's with failover features
- Inter-relay communication based on standard protocols
- Front USB for maintenance and downloading of records and events



Features (continued)

Fast Load Shed

- Fast optimal load shedding executed within 20ms
- Intelligently sheds only necessary loads per customized priorities
- Highly customizable and scalable, integrating easily into most industrial plants with new or existing EMS/SCADA
- Optional stand-alone system with local HMI for viewing dedicated system status and reports
- Suitable for small or large industrial systems without re-design
- Easy-to-use system where settings and priorities can be configured within seconds

Bay Monitoring and Metering

- CT and VT monitoring
- Metering: current, voltage, frequency, power, energy and phasors as per IEEE C37.118
- Fault recorder: 256 samples/cycle, 30 sec of storage capacity
- Disturbance recorder: 1 sample/cycle, 5 min of storage capacity
- Event recorder: 8000 time-tagged events, with 0.5 ms scan of digital inputs
- Comprehensive display of metering, phasors, maintenance and fault information in the front panel

Ease-of-Use and Security

- Graphical protection and automation logic programming
- Real-time logic monitoring to simplify commissioning and troubleshooting
- EnerVista™ Launchpad service and update notification toolset keeps documents and software up-to-date
- EnerVista Integrator providing easy integration of data (SCADA or DCS) into new or existing systems



Section 22

Notes for Fast Load Shedding:

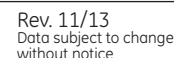
Front Panel: Can be either A or H (HMI is an option)

Automation: C or A for Controller or Aggregator

Communication Module: Only option A available

AC Module: X – none only option

MultiLink Ethernet Switch	ML3K-F-HX-A-B-E-E-W-Y-Y-X-X-X
Viewpoint Engineer	VPE-1
Viewpoint Maintenance	VPM-1
Viewpoint Monitoring IEC 61850	VP-1-61850
350 Feeder Protection	350-E-P5-G5-H-E-S-N-M-3E-D-N
339 Motor Protection	339-E-P5-G5-H-E-S-N-M-3E-D-N
F35 Feeder Protection	F35-N03-VKH-F8L-H6P-MXX-PXX
F60 Feeder Protection	F60-N03-VKH-F8L-H6P-MXX-PXX
F650 Bay Controller	F650-B-F-B-F-1-G-0-HI-6E
G30 Generator Protection	G30-N03-VKH-F8L-H6P-M8L-PXX
G60 Generator Protection	G60-N03-VKH-F8L-H6P-M8L-PXX



Relays and Meters Protection & Control HardFiber

IEC 61850 Process Bus Solution

Section 22

Key Benefits

- Save up to 50% in protection & control labor costs
- Eliminate majority of copper wiring to better utilize resources for the design, building, commissioning and maintenance of power system protection and control
- Robust and simple architecture for deploying IEC 61850 process bus
- Extremely rugged hardened switchyard interface is suitable for harsh environments without requiring specialized enclosures
- Built as an extension of the Universal Relay (UR) family of products, is available for a wide array of protection applications ranging from generation, to transmission and distribution systems
- Completely secure against cyber security threats
- Improves employee safety by limiting the number of high-energy signals in the control building



Applications

- Retrofit and greenfield installations for power generation, transmission and distribution systems
- Generator protection
- Transformer protection
- Transmission Line protection
- Bus protection
- Feeder protection
- Motor protection
- Capacitor bank protection
- Wide area network protection
- Distributed bay control
- Digital fault & sequence of event recording
- Substation automation
- Air-insulated and GIS stations

Features (continued)

- Rack-mounted Cross Connect Panels provide dedicated point-to-point passive connections between devices
- Rack-mounted Cross Connect Panels distribute DC power to switchyard devices

Features

Protection and Control

- Supported by the Universal Relay UR family of products covering most protection applications
- Dual-source architecture for maximum reliability
- Internally wetted contacts for binary status inputs
- High speed trip-rated solid state relay outputs
- Universal DC transducer inputs for RTDs, potentiometer, DC voltage or DC milliamps

Communication

- IEC 61850 9-2 Sampled Values
- IEC 61850 8-1 GOOSE
- 100 Base-BX bi-direction fiber optic Ethernet channels

Installation

- Copper interfaces using MIL-STD-38999 connectors designed to prevent incorrect installation
- Rugged outdoor fiber optic cables delivered pre-terminated to length and includes DC power wiring
- No configuration required in the switchyard



Brick						
Brick	-	4	-	HI	-	****
CT/VT Inputs						CC55 CV50 CC11
Brick base unit, 4 digital cores, 125/250 VDC nominal power supply						
5A/5A 8xCT Inputs						
5A 4xCT & 4xVT Inputs						
1A/1A 8xCT Inputs						
Cross Connect Panel						
XPC	-	16	-	HI		
HardFiber Cross Connect Panel, 16 positions, 125/250 V DC Distribution						
Fiber Cables						
FOA	-	0000	-			M***
Cable Length						001
Outdoor Brick connection cable, four fiber optic cores plus copper DC supply						
1 meter to 500 meters (3 feet to 1650 feet)						
FOR	-	0000	-			M***
Cable Length						003 005 010 015 020 025 030 040 050
Indoor relay fiber cable, four fiber optic cores						
Brick Copper Cables						
CUB	-	0000	-			M***
Cable Length						002 005 010
Contact Output Cable						
2 meters (6 feet)						
5 meters (16 feet)						
10 meters (32 feet)						
CUC	-	0000	-			M***
Cable Length						002 005 010
Contact & Transducer Input Cable						
2 meters (6 feet)						
5 meters (16 feet)						
10 meters (32 feet)						
CUD	-	****	-			M***
CT/VT Inputs		CC55 CC50 CC11 CV10				
AC Input Cable						
5A/5A 8xCT Inputs						
5A 4xCT & 4xVT inputs						
1A/1A 8xCT Inputs						
1A 4xCT & 4xVT Inputs						
Cable Length						002 005 010 020
2 meters (6 feet)						
5 meters (16 feet)						
10 meters (32 feet)						
20 meters (64 feet)						



MIV II Directional Power Protection System

Numerical reverse, forward and low forward directional power and loss of field protection relay.

Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design Flexibility - easy to use programming logic
- Access to information - Modbus® RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Flash memory for field upgrades
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- Three models available for voltage, frequency and combined protection
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista™ compatible
- Isolated RS232 port



Applications

- Voltage and/or frequency protection at any voltage in automatic transfer systems, generators, motors, lines and busbars

Features

Protection and Control

- Three-phase over and undervoltage, ground overvoltage
- Voltage unbalance, over and underfrequency, with the following options:
- Four independent time delay phase under/overvoltage elements complete with two independent fixed time ground overvoltage elements
- Four units of frequency protection
- Both voltage protection and two elements of frequency protection
- Circuit Breaker control (open/close)
- Configurable I/O
- 6 outputs, four configurable, plus trip and alarm

Monitoring and Metering

- 24-event record
- Analog/digital oscillography - 24 cycles at 8 samples per cycle
- Frequency and per-phase voltage
- Monitoring of the last 5 trips information from the display

User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus™ RTU protocol up to 19,200 bps
- EnerVista™ software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices

Ordering

MIVII	*	0	*	0	*	00	*	00	Functions
1									Voltage functions
2									Frequency functions
3									Voltage and frequency functions
		0							Voltage range: 10-250 V (all models)
		1							Voltage range: 2-60 V (only for MIVII 1000)
				E					Relay language: English
				F					Relay language: French
						LO			Power Supply: 24-48 Vdc (Range: 19~58Vdc)
						HI			Power Supply: 110-250 Vdc (Range: 88~300Vdc)
									Power Supply: 100-230 Vdc (Range: 88~264Vac)

Visit www.GEMultilin.com/MIVII to:

- View Guideform specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIV II online
- View the MIV II brochure



Relays and Meters

Protection & Control

MIN II Ground Protection System

Complete numerical ground directional protection

Section 22

Key Benefits

- Reduce troubleshooting and maintenance cost - event recording, and analog/digital oscillography
- Design flexibility - Easy to use programming logic
- Access to information - Modbus RTU communications
- Configurable logic, curves, digital I/Os, and LEDs
- Follow technology evolution - Flash memory for product field upgrade
- Asset monitoring - Breaker health, and breaker failure protection
- Two settings groups
- Password protection for local operation
- Automatic display of last fault information
- AC/DC power supply
- Access via front panel keypad or communication links
- EnerVista™ compatible
- Isolated RS232 port



Applications

- Directional ground protection at any voltage level
- Backup/auxiliary protection for line schemes
- Component relay for transformers, generators and motors

Features

Protection and Control

- 2 ground IOC (high and low) units for grounded systems
- 2 ground TOC (high and low) units for grounded systems
- 2 directional units for grounded systems
- 2 directional overcurrent units for Petersen Coil
- 2 directional overcurrent units for isolated ground
- Directional comparison: scheme logic
- 4 preconfigured overcurrent curves (ANSI or IEC)
- Configurable breaker failure protection
- Configurable I/O
- 6 outputs: trip, service, 4 auxiliary

Monitoring and Metering

- 32-event record, analog/digital oscillography
- Ground current metering
- Monitoring of the last 5 trips information from the display

User Interfaces

- 2x16 character LCD display
- 6 LED indicators, 4 configurable in function and color
- Front RS232 and rear RS485 ports using ModBus™ RTU protocol up to 19,200 bps
- EnerVista™ software - an industry leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices

Ordering

MINII	*	*	0	*	E	0	0	*	0	0	Description
	N	L									Basic Model
	A	I									With logic for teleprotection schemes (see Note 1)
											ANSI Curves
											IEC Curves (see Note 2)
					E						Application
					S						Grounded system (In = 1 or 5 A)
											Isolated ground / Petersen Coil
									LO		Power Supply:
									HI		24-48 Vdc (Range: 19~58 Vdc)
											110-250 Vdc (Range: 88~300 Vdc)
											110-240 Vac (Range: 88~264 Vac)

Visit www.GEMultilin.com/MINII to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a MIN II online
- View the MIN II brochure



The Remote RTD Module provides additional RTD temperature metering capabilities for the GE Multilin™ 369 Motor Protection System. The module can also operate as a stand-alone temperature monitoring transducer and can provide overtemperature protection (I/O).

Key Benefits

- Additional RTD temperature metering for the GE Multilin™ 369
- Designed for close mounting to motor (reduces wiring)
- Operates as stand-alone temperature monitoring transducer
- Provides overtemperature protection
- Monitors up to 12 RTDs
- Individually field programmable RTD inputs
- AC/DC universal power supply

Applications

- Stand alone RTD protection for all motors
- Connect to the 369 Motor protection System to provide Remote RTD protection, as well as additional I/O

Features

Protection and Control

- RTD Overtemperature

Automation

- Programmable Inputs and Outputs
- Analog Outputs

Monitoring and Metering

- RTD Temperature

Communications

- Networking via RS485 Serial Ports
- Optional Fiber Optic Port
- Modbus RTU Protocol
- Optional Profibus

EnerVista™ Software

- State of the art software for configuration and commissioning GE Multilin™ products
- Document and software archiving toolset to ensure reference material and device utilities are up-to-date
- EnerVista™ Integrator providing easy integration of data in the RRTD into new or existing monitoring and control systems



Ordering

RRTD	*	*	*	*
RRTD	HI	LO	IO	0
				F
				0

50 – 300 VDC/40 – 265 VAC
20 – 60 VDC/20 – 48 VAC

Optional input and output
No optional input and output
Optional fiber optic port
No optional fiber optic port

Note: The control power (HI or LO) must be specified with all orders.

Accessories for the RRTD

Viewpoint Monitoring	VP-1
Multinet™ Serial to Ethernet converter	MULTINET-FE

Visit www.GEMultilin.com/RRTD to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy an RRTD online



DDFR™ Distributed Digital Fault Recorder

Utilizing the fault recording power you already possess

The GE Multilin™ DDFR™ is a Power System Fault Recorder that collects, archives and manages Disturbance and Fault information that is recorded by microprocessor based protective relays distributed throughout your local power system.

Key Benefits

- Provides a permanent detailed record of all substation activity at a fraction of the cost of installing traditional Digital Fault Recorders (DFR)
- Eliminates up to one-third of substation wiring needed for protection, metering and disturbance recording
- Allows for recording of Transfer Trip Signals, Block Signals and other inter-substation messages that are sent via IEC61850 peer-to-peer messages and not recordable by traditional DFR's
- Permits recording of internal protection relay operands and calculations in Sequence of Events (SOE) and Fault records
- Meets requirements of international Fault Recording standards when used with GE Multilin™'s Universal Relay family including NERC, IEEE, ECAR, & NPCC

Applications

- Substation Distributed Digital Fault Recording
- Component in a larger enterprise wide fault and disturbance recording system

Features

- Retrieves and Archives Transient Fault Records, Sequence of Event Records, and Disturbance Records recorded in protection relays distributed across the substation
- Automatically merges Events recorded in protection relays distributed across the network into a single substation wide Sequence of Event Record
- Stores months of fault and disturbance records internally, facilitating local substation analysis
- Effortlessly archives recorded data to a permanent enterprise network location or server for remote investigation and analysis



Relays and Meters

Protection & Control

DDFR Distributed Digital Fault Recorder

Specifications/Ordering

Meets Standard DFR Requirements

When used with advanced microprocessor based relays such as the UR family, the DDFR System meets or exceeds requirements of International Standards for Digital Fault Recording.

DDFR Recording Specifications when used with the UR Family

Sequence of Event Records (SOE)	
Timestamp Resolution	0.5 ms Digital Inputs, 2.0 ms Protection Elements
Time Synchronization	IRIG-B, SNTP
Digital Input Quantity	96 x number of UR's
Data Available	Digital Input Status Changes, Protection Element Status Changes, Automation Logic Status Changes, Peer-to-Peer Communication Messaging (IEC61850)
Transient Fault Recording	
Sample Rate	Up to 64 samples/cycle
Length of Record	Up to 2 sec. @ 64samples/cycle
Number of Analog Channels	24 x number of UR's
Number of Digital Channels	64 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF, Harmonics, Symmetrical Components, Calculated Protection Quantities (Diff/Rest Current etc.) Digital Status - Contact I/O, Remote I/O, Virtual I/O, Protection Element Status
File Format	COMTRADE
Trigger	Configurable
Disturbance Record	
Sample Rate	Up to 1 samples/cycle
Length of Record	Up to 120 seconds @ 1 samples/cycle with 8 Analog Channels
Number of Analog Channels	16 x number of UR's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF, Harmonics, Symmetrical Components, Calculated Protection Quantities (Diff/Rest Current etc.)
File Format	COMTRADE

DDFR Recording Specifications when used with the SR Family

Sequence of Event Record (SOE)	
Timestamp Resolution	14 ms Digital Inputs and Protection Elements
Time Synchronization	IRIG-B
Digital Input Quantity	16 x # of SR750's & SR745's, 9 x # of SR469's & SR489's
Data Available	Digital Input Status Changes Protection Element Status Changes
Transient Fault Recording	
Sample Rate	16 samples/cycle SR750, SR469, SR 489, 64 samples/cycle SR745
Length of Record	2 sec. - SR750 1 sec. - SR469, SR489 250 ms - SR745
Number of Analog Channels	8 x number of SR relays
Data Available	Voltage Phasors Current Phasors COMTRADE
File Format	Configurable
Trigger	
Disturbance Record (750 Only)	
Sample Rate	Up to 1 samples/cycle
Length of Record	Up to 34 sec. @ 1 samples/cycle
Number of Analog Channels	8 x number of SR750's
Data Available	V, I, Vrms, Irms, Hz, W, VA, vars, PF,
File Format	COMTRADE
Trigger	Configurable

Ordering

DDFR	**	**	Description
	HI		120-230 VAC / 110-250 VDC
	LO		24-48 VDC
		HI	Redundant 120-230 VAC / 110-250 VDC
		LO	Redundant 24-48 VDC

Visit www.GEMultilin.com/DDFR to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a DDFR online



Relays and Meters Protection & Control

Single Function Protection Relays

Overcurrent Relays

Section 22

IFC Time Overcurrent Relay



Applications

- Feeder, AC machines and transformers
- Inverse time/current applications

Protection and Control

- Ground and phase time over and undercurrent
- Overload motor protection
- IOC (optional)

Features

- Six inverse time/current operating curves
- Instantaneous current ranges
- Extended time current ranges
- Target seal-in units available
- Instantaneous units available
- High seismic capability
- Molded drawout case with clear cover

IAC Time Overcurrent Relay



Applications

- Feeder, AC machines and transformers
- Applications where operating time is inverse to operating current

Protection and Control

- Ground and phase time over and undercurrent
- Overload motor protection
- IOC (optional)

Features

- Six inverse time/current operating curves
- Target seal-in units available
- Instantaneous units available
- Drawout case

PJC Instantaneous Overcurrent Relay



Applications

- Feeder circuit overcurrent protection
- High-speed, non-directional AC/DC current

Protection and Control

- Instantaneous over and undercurrent

Features

- Self-reset or manual-reset relays
- Mechanical target available
- Up to three independent units per case
- Molded or drawout case available

DIAC/DIFC/DSFC Single-Phase Digital Overcurrent Protection



Applications

- Industrial and utility power systems
- Feeders, transmission lines, AC-machines, transformers
- Facilities with medium voltage switchgear
- 50 or 60 Hz

Protection and Control

- Phase or ground overcurrent
- Separate TOC and IOC protection
- Wide pickup setting ranges
- 16 TOC curve characteristics
- RMS sensing
- Reset characteristic selection
- Manual trip levers

User Interfaces

- Pickup status LED
- TOC and IOC latched indicators
- Target reset

Features

- Three models: DIAC, DIFC, DSFC
- Direct/functional replacement of IAC, IFC, SFC
- Self-powered
- Reduced maintenance costs
- Low burden
- Drawout case



Relays and Meters

Protection & Control

Single Function Protection Relays

Overcurrent Relays

Section 22

CHC Instantaneous Overcurrent Relay



Application

- Three-phase and ground fault in circuit breaker failure schemes

Protection and Control

- Three-phase and ground IOC
- Time delay operation

Features

- Electrically separate contacts available
- Drawout case

IFCV Relay with Voltage Restraint



Applications

- System fault backup protection
- Generator fault backup protection

Protection and Control

- TOC unit with voltage restraint
- IOC unit available

Features

- Inverse time-current operating curve
- Two electrically separate contacts
- Target seal-in unit
- Induction unit design
- Drawout case

SGC Negative Sequence Overcurrent



Application

- Generator negative sequence heating protection

Protection and Control

- Negative sequence TOC

Features

- K setting selection from K = 2 to 40
- Reset function approximates machine cooling
- Remote I_2 readout meter available
- Alarm function available
- Electrically operated target seal-in
- Alarm level LED available
- Drawout case

Ground Fault Relay



Application

- Protects electrical equipment from ground faults when used with a matching Sensor

Protection and Control

- Panel or door mount
- Adjustable time delay
- LED power or indicator
- Visual trip indicator
- Trip Currents 5 - 60 , 30 - 360 or 100 -1200 - A
- UL listed and CSA Approved



MLJ MID Digital Synchronism Check Relay



Applications

- Generator and network synchronism
- Bus or line synchronism check
- Manual closing of breakers

Protection and Control

- Synchronism check
- Undervoltage supervision
- DLDB, DLLB and LLDB indication

Features

- RS485, RS232 or fiber communications available
- Configurable auxiliary outputs
- V f Hz line and bus metering
- Continuous or manual modes
- Part of a modular system
- Independent 2" or 4" modules
- 1/4 or 1/8 standard 19" rack case available
- Three-digit display

IJS Synchronism Check Relay



Application

- Bus or line synchronism check

Protection and Control

- Synchronism check
- Adjustable time delay
- Selectable phase calibration range
- Instantaneous bus and line undervoltage
- Time delay dead-line live-bus and/or deadbus live-line check

Features

- Telephone type relay units available
- Mechanical targets available
- Drawout case

Relays and Meters

Protection & Control

Single Function Protection Relays

Voltage and Frequency Relays

Section 22

TOV MID Modular Voltage Relay



Applications

- Automatic transfer equipment
- Automatic control systems
- Component for complex protection schemes

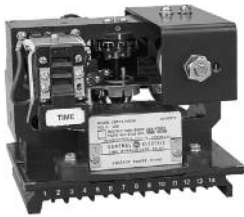
Protection and Control

- Instantaneous over and undervoltage
- Time delay over and undervoltage
- Phase to ground fault detection in isolated neutral systems
- Third harmonic filter (single-phase)

Features

- Part of a modular system
- Independent 2" modules
- 1/8 standard 19" rack cases available
- LED indicators and reset button
- Trip, auxiliary, and power supply alarm

IFV Time Delay Voltage Relay



Applications

- AC generators
- Ungrounded three-phase distribution system
- Time delay pickup or dropout

Protection and Control

- Time delay overvoltage
- Ground detection on ungrounded systems and equipment neutrals
- Instantaneous overvoltage available

Features

- Frequency compensation (optional)
- Target seal-in unit on all contacts
- Instantaneous, hinged armature type units (optional)
- Drawout case

NBV Voltage Unbalance Relay



Applications

- Motor bus
- Detection of upstream blown fuse

Protection and Control

- Three-phase voltage unbalance

Applications

- System fault backup protection
- Generator fault backup protection

Protection and Control

- TOC unit with voltage restraint
- IOC unit available

Features

- Inverse time-current operating curve
- Two electrically separate contacts
- Target seal-in unit
- Induction unit design
- Drawout case



BDD Percentage Differential with Harmonic Restraint



Application

- Current differential single-phase

Protection and Control

- High-speed percentage differential
- Phase and ground fault detection
- Current restraint circuits available
- Percent differential slope selection

Features

- No auxiliary CT's are required
- Ratio matching taps
- Harmonic restraint prevents incorrect tripping upon transformer energization
- Self-contained target indicator
- Inherently selective
- Drawout case

STD Percentage Differential with Harmonic Restraint



Applications

- Power and autotransformer protection
- Current differential single-phase (three required per transformer)

Protection and Control

- High-speed percentage differential
- Harmonic restraint
- Hinged armature instantaneous unit

Features

- Adjustable restraint slope
- Inherently selective
- Drawout case

CFD High-Speed Differential Relay



Applications

- Generators, 2000 kVA and above
- Motors and synchronous condensers, 3000 hp (or kVA) and above

Protection and Control

- High-speed percent differential protection

Features

- Variable percentage slope operating characteristic
- Product restraint principle
- Drawout case



PVD Differential Voltage Relay



Key Values

- High security and reliability
- High speed protection
- Large installed base ... over 60 years of service experience
- Easy integration with timing relays for breaker failure function

Applications

- Bus differential high z voltage
- Shunt reactor differential protection
- Transformer high z ground differential

Protection and Control

- High-speed, high z voltage sensing
- High-seismic IOC unit
- Breaker failure protection (with suitable timing relay)

Features

- Replacement for earlier PVD models
- Thyrite stacks limit potential voltage across relay
- Drawout case

IJD Percentage Differential Relay



Applications

- AC rotating machines (IJD52)
- Power transformers (IJD53)

Protection and Control

- Fixed slope percentage differential

Features

- Single and three-phase units available
- Various percentage slopes available
- Electrically operated target seal-in unit
- Restraint current matching taps (IJD53)
- Drawout case

SBD Differential Voltage Relay



Key Values

- High security and reliability
- High speed protection
- Large installed base ... over 60 years of service experience
- Easy integration with timing relays for breaker failure function
- Sub-cycle protection

Applications

- Bus and feeder differential protection
- Shunt reactor differential protection

Protection and Control

- Sensitive, high-speed differential protection
- Phase and ground fault detection (requires three relays)
- Breaker failure initiation when used with a suitable timing relay
- High-impedance voltage measurement with overcurrent supervision

Relays and Meters

Protection & Control

Single Function Protection Relays

Section 22

Directional Relays

JBC/JBCG

Phase and Ground Direction Overcurrent Relays



Applications

- Directional phase fault protection (JBC)
- Directional ground fault protection (JBCG)

Protection and Control

- TOC
- IOC
- Voltage-restrained phase overcurrent

Features

- Mechanical targets
- Three inverse time/current characteristics
- Drawout case

JBCV Directional Relays

Directional overcurrent protection of feeders and transmission lines



- JBCV relays consist of three units, an instantaneous power-directional unit of the induction-cup type, a TOC unit of the induction-disk type, and an IOC unit of the induction-cup type

Timing Relays

SAM Static Timing Relay



Applications

- Accurate and repeatable timing functions
- Distance relay timing

Protection and Control

- Accurate repeatable timing for contact closure control

Features

- High-reliability solid-state components
- Single or dual timing units available
- Timing range of 0.10 to 9.99 sec
- Various output contact arrangements available
- Front panel settings adjustment
- Flush mounting
- Drawout case

IAV Time Delay Voltage Relay



Applications

- AC Generators (including Hydro)
- Distribution feeder
- Time delay pickup or dropout

Protection and Control

- Generator overvoltage
- Feeder over and undervoltage
- Ground detection

Features

- Frequency compensation (optional)
- Target seal-in unit (most units)
- Instantaneous units (optional)



CEH Loss of Excitation Relay



Application

- Generators (all types)

Protection and Control

- Loss of excitation
- Impedance unit
- Second z unit with a timer available

Features

- High-speed tripping
- Drawout case

GGP Power Differential Relay



Applications

- Turbine-driven generators
- Prevent turbine damage

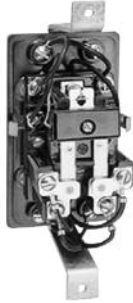
Protection and Control

- Three-phase reverse power

Features

- Suitable for unbalanced loads
- Up to 30 second delay included
- Electrically separate main and timing contacts
- Electrically operated target and seal-in unit
- Drawout case

HGA 18 Reclosing Relays



Single-shot Reclosing Relays

- Single-shot reclosing relays for distribution and transmission

Capacitor Trip Device



Applications

- Provide a power source in the event of a loss of AC control voltage
- Switchgear and motor control

Features

- Six models available
- Capacitor is continuously charged when control power is available
- Battery back - up is also available on certain models
- Inputs 120/240 VAC 50/60 Hz
- UL Listed and CUL

Visit www.GEMultilin.com/relays to:

- View Guideform specifications
- Download instruction manuals
- Review applications notes and support documents
- Buy a relay online
- View product brochures



Relays and Meters

Protection & Control

Single Function Auxiliary Relays

Section 22

Multicontact Auxiliary Relays

HEA Multicontact Auxiliary Relay



Application

- Contact multiplication

Protection and Control

- Trip and/or block close breaker control
- Electrically separate outputs available
- Various shaft lengths available

HSA Multicontact Auxiliary Relay



Application

- Contact multiplication

Protection and Control

- Trip and/or block close circuit breaker control
- Electrically separate contact outputs
- Universal target dropping
- Mechanical target
- High seismic capability

HFA Multicontact Auxiliary Relay



Application

- Contact multiplication

Protection and Control

- Standard, high-speed or variable time tripping available
- Manual, self or electric reset available
- Electrically separate contact circuits
- Molded case with three mounting options
- Drawout case available

High-Speed Trip & Contact Relay

RDB86 High-Speed Trip and Lockout Relays



Applications

- Line breaker tripping and lockout
- Contact multiplication
- High-speed breaker circuits
- Transformer lockout

Protection and Control

- Circuit opening and/or closing
- Auto-cut contacts
- Electrically separated contact circuits
- Electrically or manually operated
- Semi-flush mounted case
- Back connected
- Custom mounted cases available



Relays and Meters

Protection & Control

Single Function Auxiliary Relays

Section 22

HAA Auxiliary or Annunciator Relay



Applications

- When a target is required
- When alarm or similar functions required
- Interposing relay in conjunction with transformer SP relay

Protection and Control

- Auxiliary contacts and targeting
- Current operated units available
- High-speed DC voltage operated units available
- Drawout case available
- Molded case with three mounting options available

NGA Auxiliary Relay



Application

- Contact Multiplication

Protection and Control

- Various pickup and dropout times available
- Telephone type unit
- Small molded case
- Front or back connections available
- Surge limiting available

HMA Hinged Armature Auxiliary Relay



Application

- Contact multiplication

Protection and Control

- High-speed pickup
- Self-resetting
- Front or back connected
- Molded textolite case

HGA Hinged Armature Auxiliary Relay



Application

- Contact multiplication

Protection and Control

- Standard, low and variable time pickup available
- AC undervoltage (low dropout)
- Molded case with four mounting options
- Drawout case available

Visit www.GEMultilin.com/relays to:

- View Guideform specifications
- Download instruction manuals
- Review applications notes and support documents
- Buy a relay online
- View product brochures



Relays and Meters

Substation Gateways and RTU

D400™ Advanced Substation Gateway

Section 22

Key Benefits

- Direct support for industry standard communication protocols (including IEC® 61850) helps ensure connectivity with new and legacy substation devices and master stations —Record faults and events with time stamp - identify and respond to PQ events quickly
- Reduce configuration and maintenance effort using the intuitive configuration interface with drop down menus, easy-to-use workflows, pre-configured device maps, built-in HMI and built-in substation automation applications
- Integrate the Multilin D400 Substation Gateway into NERC® CIP compliant systems using the built-in advanced security features
- Cost effective deployment of new and retrofit substation automation projects with the compatible, proven technology of the Multilin D20 Input/Output peripheral modules
- Improve operation processes allowing personnel to securely access substation devices remotely
- Simplify event analysis and system planning with fast access to non-operational data, such as fault records, sequence of events, settings files, which is automatically collected and distributed by the Multilin D400 for use by different groups within the utility

Applications

- Advanced gateway: substation data collection, concentration, visualization and trending
- Advanced automation: implement custom substation logic and procedures using IEC 61131 compliant tools
- Automate non-operational data management collecting files from IEDs and distributing to user defined locations for archiving and use by different user groups within the utility
- Cost effective deployment of new and retrofit substation automation projects through compatibility of Multilin D400 Substation Gateways and Multilin D20 Input/Output peripheral modules enabling users who have standardized on the D20 to maintain and leverage existing designs, processes and infrastructure
- Securely access substation devices locally and remotely

Features

Advanced Automation

- Built-in alarm annunciator
- Built-in one line diagrams editor
- IEC 61131 soft logic using Logiclinx™
- Analog/digital data logging with web-based viewer and .CSV file export

Security

- Centralized user authentication (RADIUS®, TACACS+®)
- Role Based Access Control (RBAC)
- Full auditing including syslog
- Secure access using SSH/SCP/HTTPS
- Secure web server (128 bit encryption)
- Built-in firewall



Features (continued)

Connectivity

- Multiple simultaneous SCADA protocols and firmware including DNP3, Modbus, IEC 101 Server, IEC 103 Client, Calculator, and System Point Manager
- Event notification via email/pager
- Automatic record retrieval application for archiving and transfer of IED files (SOE, Fault Records)
- Support for up to 16 RS232/RS485 serial ports and up to 64 virtual serial ports
- Support for VLAN communications

Hardware

- Dual hot swappable power supplies
- RS485 2kV RMS rated ports
- Built-in Ethernet switch (10/100Base T or 100Base FX)
- Dual Ethernet controllers option
- Optional Multilin D.20™ RIO Distributed I/O Controller external interface module for communication with D20 I/O modules



Section 22

Ordering Note: For the latest ordering information visit our online store at GEDigitalEnergy.com/onlinestore

Compact Flash Card 2GB	160-0119
D400 Touch Screen/Keyboard/Mouse Kit	501-0912
Switch Control, External HMI	540-0255
D400 Dual Ethernet Upgrade Kit	501-0612
D.20 RIO unit with 100-240VAC / 110-290VDC Output 24 VDC Power Supply	DPDA000029
D.20 RIO unit with 85-264 VAC / 90-350VDC Output 48 VDC Power Supply	DPDA000030

- View Specification Sheet
- Download the instruction manual
- Review applications notes and support documents
- Obtain ordering information



Relays and Meters

Substation Gateways and RTU

D20MX™ Substation Controller

Section 22

Key Benefits

- Reduce legacy D20 RTUs upgrade cost by over 50% through backwards compatibility with earlier versions of the Multilin D20 Substation Controllers and D20 peripheral modules
- Minimize operation and maintenance cost by leveraging existing D20 based designs, processes and infrastructure
- Comply with NERC-CIP® requirements through native cyber security features built into the D20MX Substation Controller
- Simplify implementation and operation of NERC-CIP architectures with open standard cyber security features

Applications

- Integrate D20 Substation Controllers into NERC-CIP environments using built in cyber security features
- Automate data acquisition and control remote electrical substations with key industrial protocols such as DNP3
- Dual and Single IP redundancy
- Concurrent communications with multiple masters and substation devices though built in dual Ethernet controllers and RS232 serial ports
- Robust advanced automation applications based on over two decades of experience

Features

Cost Effective Upgrade of Legacy D20 RTUs

- Backwards compatible with earlier vintages of D20 RTU chassis including VME and non VME versions
- Built in dual D.20 communication channels for interface with the popular series of Multilin D20 peripheral devices
- Simplified migration of key D20 applications such as DNP3

Advanced Automation

- Supports multiple, simultaneous SCADA protocols for communications to multiple masters
- Built in dual Ethernet communication ports that can support multiple protocols simultaneously
- Robust advanced automation applications based on over two decades of experience

Advanced Cyber Security and Risk Management

- Centralized user authentication (RADIUS)
- Role Based Access Control (RBAC) keeping operator and engineering activities separated, logged and simple
- NERC compliant passwords, case sensitive and encrypted
- Full auditing including Syslog integration to enterprise systems
- SSH and SFTP for secure firmware and configuration file transfer



Relays and Meters

Substation Gateways and RTU

D20MX™ Substation Controller

Ordering

Section 22

D20MX	*	X	X	*	*	*	*	*	*	Description
CPU Options	A									D20MX non-VME, dual 10/100/1000BASE-TX Ethernet Ports (front access)
	C									D20MX non-VME dual 100BASE-FX Ethernet Ports (front access)
	G									D20MX non-VME, dual 100BASE-FX Ethernet Ports (rear access)
Power Supply				U						Not required
				A						20-60VDC Input, 24V ISO Output
				B						20-60VDC Input, 48V ISO Output
				C						100-300VDC/85-264VAC Input, 24V ISO Output
				D						100-300VDC/85-264VAC Input, 48V ISO Output
Modem Slots				U	U	U				Empty slot with cover plate
				A	A	A				Wesdac D20 202 bin modem
				C	C	C				Telenetics 14400 baud modem 2-wire dial up
				D						Telenetics 14400 baud modem 4-wire leased line
				E						D20MX dual 100BASE-FX ST Media Interface Card
				F						D20MX dual 100 BASE-FX LC Media Interface Card
Serial Termination Panel								A		19" Rack Mount Serial IO Western Panel
								B		D20 Chassis Mounted Serial IO Western Panel
								C		D20 Chassis Mounted Serial IO Western Panel w/Extended Bracket
Firmware Options								A		D20MX firmware v1.00, B021(v988) / B009(v400)
								B		D20MX firmware v1.00 - B021(v912) / B009(v310)

D20MX Upgrade Kits

Three D20 MX upgrade kits are available:

Part Number	Description
D20MX-N-SET-F-XX-X	D20MX CPU, 2 x 10/100/1000 Base TX Front Access ports (RJ45)
D20MX-N-SEF-F-XX-X	D20MX CPU, 2 x 100 Base FX Front access ports (ST Connectors)
D20MX-N-SEF-R-XX-X	D20MX CPU, 2 x 100 Base FX Rear Access ports (ST Connectors)

Upgrade kits include the necessary items required to upgrade existing D20 RTUs including:

- New D20MX CPU
- Blank Plates
- Multilin Products Documentation CD
- Multilin D20MX Documentation CD
- Multilin SGConfig Setup Software DVD
- Ferrite Core for D20 Power Wiring
- 0V Cable



Relays and Meters

Substation Gateways and RTU

D.20™ RIO Distributed I/O Controller

Section 22

Key Benefits

- Reduced copper wiring between I/O modules and substation controllers by adding I/O near the monitored device and communicating to the Multilin D400 over the substation LAN
- Easy installation of the small form factor D.20 RIO into existing control panels
- Cost effective deployment of new and retrofit substation automation projects through compatibility of Multilin D400 Substation Gateways and Multilin D20 Input / Output peripheral modules

Applications

- The D20 module interface enables users to maintain and leverage existing engineering designs, processes and automation infrastructure
- Simplify implementation of distributed substation automation architectures by installing I/O where it's needed and reducing copper wiring between I/O and substation controller

Features

Ease of Use

- No special configuration tools are required, the device is connected via Ethernet using a standard web browser
- The Multilin D400 automatically detects the D.20 RIO and establishes communications with the D20 modules
- Intuitive user interface integrates the D20 I/O modules within minutes
- Compatible with v3.X series of the D20 I/O PCommon code
- No Substation LAN? No problem. Connect the D.20 RIO to the built in D400 Ethernet switch

Hardware

- Product supplied with accessories for multiple mounting options (19" rack, DIN Rail, panel mount)
- Support for dual D.20 communication links
- Jumper configurable option for internal or external wetting of D20 peripherals



Ordering

DPDA000029:

Multilin D.20 RIO, Power Input: 85 to 264 VAC,
45 to 65 Hz., or 90 to 350 VDC. Output: 24 VDC / 3.5 A

DPDA000030:

Multilin D.20 RIO, Power Input: 85 to 264 VAC,
45 to 65 Hz., or 90 to 350 VDC. Output: 48 VDC / 5.0 A



Relays and Meters

Substation Gateways and RTU

D25 Multifunction Bay Controller/RTU

Flexible, Reliable Substation Automation & Control

Section 22

Key Benefits

- Flexible IEC 61850 Server provides easy integration of substation automation systems without the need to replace any existing equipment
- Advanced IEC 61131-3 compliant PLC logic engine eliminates the need for additional PLCs or other automation devices
- Support for industry standard SCADA protocols ensures easy integration into new or existing systems, reducing engineering time & costs
- Easy-to-use front touch-screen HMI eliminates the need for additional local bay control units
- Advanced Power quality monitoring and digital fault recording capabilities eliminate the need for separate devices
- Manages and preserves all event and original I/O time tags for reliable sequence of events recording
- Redundant I/O monitoring and management for bay control, reduces the number of I/O required by master stations
- Advanced transformer monitoring and control ensures optimized loading and extended equipment life
- Embedded high-current control eliminates the need for separate interposing relay panels

Applications

- Communications and data concentrator
- Advanced automation controller
- Metering, sequence of events & fault recording device
- Transformer monitoring and controller

Features

Advanced Automation & Control

- Synchronism check
- Dynamic bus switching
- Auto-restoration schemes
- Load shedding schemes
- PLC logic programming (LogicLinx™)
- AC analog alarming

Communications

- Local Remote Unit (LRU) allowing for multiple masters and slaves communicating multiple SCADA protocols
- Protocol conversion from legacy to modern industry standard
- Redundant Ethernet, fiber, or copper communications
- RS232/RS485 with up to 4 software configurable channels
- IEC 61850 Server
- GOOSE/GSSE messaging

Metering & Recording

- Advanced digital fault recording
- 1ms time tag preservation
- Harmonic spectrum up to 21st harmonic
- Power quality monitoring including sags and swells
- Graphical, touch-screen HMI with alarms and one-line diagrams
- AC profiling of all inputs



Features (continued)

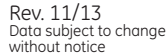
Transformer Monitoring and Control

- Cooling control module
- Cooling efficiency model
- Moisture model
- Dynamic loading model
- Winding hot spot analysis model
- Insulation aging model



Section 22

- View Fact Sheets
- Download the instruction manual
- Review applications notes and support documents
- Obtain ordering information



Digital Metering Family—Electronic Power Metering

Energy/demand data logging meters

Key Benefits

- Complete line of high-performance meters for power, energy and power quality for commercial, utilities, municipalities, and IPP applications
- Record faults and events with time stamp - identify and respond to PQ events quickly
- Monitor reliability of breakers and relays to improve operational efficiencies
- Identify and manage peak demand - shed or shift loads
- Enhance levels of communication and data transmission
- Provide real time data on the web
- Built-in RTU functionality with I/Os
- Submetering cost allocation

Applications

- View energy usage and generate bills
- Efficiently control and manage energy consumption
- Increase power distribution reliability
- Real-time PQ monitoring and analysis
- Improve substation automation solutions

Features

Monitoring and Metering

- Current, voltage, real and reactive power, energy use, cost of power, power factor and frequency
- Revenue class metering with data logging
- Harmonic analysis to 255th order with flicker and waveform recording

Control

- Fully programmable set-points for alarms and relay activation
- 90msec. high-speed updates for control
- Built-in PLC & RTU functionality

Communications

- On-board RS-485, Ethernet TCP/IP and web capability
- Built-in communication ports using open architecture protocols
- Choice of LED and LCD touch screen display
- Analog and digital inputs and outputs



Features EPM 2200 EPM 6000 EPM 6010 PQMII EPM 7000 EPM 9450 EPM 9650 EPM 9800 EPM 9900

Energy & Measurement Accuracy									
Active Energy Measurement Accuracy	0.5%	0.2%	0.2%	0.40%	0.20%	0.04%	0.04%	0.06%	0.06%
Energy Accuracy Meets or Exceeds ANSI Class	C12.20 Class 0.5	C12.20 Class 0.2	C12.20 Class 0.2		C12.20 Class 0.2	C12.20 Class 0.2	C12.20 Class 0.2	C12.20 Class 0.2	C12.20 Class 0.2
Power and Energy Measurement									
Voltage, Current, Frequency, Power Factor	•	•	•	•	•	•	•	•	•
Power (kW, kVAR, kVA)	•	•	•	•	•	•	•	•	•
Bi-Directional Power	•	•	•	•	•	•	•	•	•
Energy (kWh, kVARh, kVAh)	•	•	•	•	•	•	•	•	•
Demand	•	•	•	•	•	•	•	•	•
Demand-Time-of-Use Support			•		•	•	•	•	
Power Quality									
Harmonics - THD		•	•	•	•	•	•	•	•
Sags & Swells				•	•	•	•	•	•
Harmonics-Spectrum Analysis			•	•	•	•	•	•	
Crest-Factor				•					
Subcycle Transient Detection						•	•	•	•
K-Factor						•	•	•	•
EN50160 Flicker & Compliance							•	•	•
EN61000-4-30 Class A Reporting									•
Data Logging									
History Logs				•	•	•	•	•	•
Event Logs				•	•	•	•	•	•
Maximum Logging Memory				192KB	4MB	512KB	4MB	4MB	1GB
Event-Driven Waveform Capture				•	•	•	•	•	•
Maximum Waveform Capture Rate Samples/Cycle				64	512	512	512	512	1024
Time Synchronization via IRIG-B						•	•	•	•
Transient Recorder Samples/Cycle									166,000
Automation and I/O									
KY2 Pulse Output	•	•	•	•	•	•	•	•	•
Alarm Annunciation via Relay				•	•	•	•	•	•
Analog Input (Max)				1	0	32	32	32	
Analog Output (Max)				4	8	32	32	32	
Digital Input (Max)				4	8	40	40	40	40
Digital Output (Max)				4	4	16	16	16	4
Control Relay (Max)				4	4	16	16	16	12
Communications and Protocols									
RS-485 / Modbus RTU	•	•		•	•	•	•	•	•
Front Communication Port		•	•	•	•	•	•	•	•
Ethernet Port / Modbus TCP		•	•		•	•	•	•	•
DNP 3.0		•	•	•	•	•	•	•	•
Embedded Web Server			•		•	•	•	•	•
BACnet/IP			•						
Modem						•	•	•	
Modbus Master Capability									•
Color Touch Screen Display									•



Relays and Meters

Metering

Section 22

PQM II Power Quality Meter

Continuous metering of three-phase systems

Key Benefits

- Power quality metering with waveform capture and historical data logging
- Easy to program and use with keypad and large illuminated 40 character display
- Multiple communication ports for integration with DCS and SCADA systems
- Supports DNP 3.0 and Modbus protocols
- Digital and analog I/Os for control and alarms
- Voltage disturbance recording capability for electrical sag and swell events.

Applications

- Metering of distribution feeders, transformers, generators, capacitor banks and motors
- Medium and low voltage systems
- Commercial, industrial, utility
- Flexible control for demand load shedding, power factor, etc.

Features

Monitoring and Metering

- Ia Ib Ic In
- Va Vb Vc Vab Vbc Vca
- V I unbalance
- True PF crest and K factor
- Hz W var VA
- Wh varh VAh W cost
- Demand: A W var VA
- Harmonic analysis through 63rd with THD and TIF
- Event recorder - 150 events
- Waveform capture
- Data logger -98,000 events
- Voltage Disturbance Recorder (VDR) -500 events

Ordering

PQM II	*	*	*	Description
PQM II				Basic unit with display, all current/voltage/power measurements, 1-RS485 comm port, 1 RS232 comm port
	T20			Transducer option; 4 isolated analog outputs 0 – 20 mA and 4 – 20 mA, assignable to all measured parameters, 4 – 20 mA analog input, 2nd RS485 comm port
	T1			Transducer option; 4 isolated analog outputs 0 – 1 mA, assignable to all measured parameters, 4 – 20 mA analog input, 2nd RS485 comm port
		C		Control option; 3 additional programmable output relays (total of 4), 4-programmable switch inputs
			A	Power analysis option; harmonic analysis, triggered trace memory waveform capture, event record, data logger, voltage disturbance recorder (VDR)

Modifications:

MOD 501:	20 – 60 VDC/20 – 48 VAC control power
MOD 502:	Tropicalization
MOD 504:	Removable terminal blocks
MOD 507:	-40 to +60° C temperature operation

Control Power:

90 – 300 VDC/70 – 265 VAC standard
20 – 60 VDC/20 – 48 VAC (MOD 501)



Features (continued)

Communications

- Front RS232 serial port (1,200 to 19,200 bps)
- Two rear RS485 serial ports with ModBus and DNP 3.0 protocol
- Ethernet connectivity provided by MultiNet™
- EnerVista™ software is provided for setup and monitoring functions
- External dial-in modem capabilities

Protection and Control

- Load shedding
- Power factor control
- Pulse input totalizing

Accessories for the PQM II

Multilink Ethernet Switch	ML1600-HI-A2-A2
MultiNet™	MultiNet-FE
Viewpoint Monitoring	VP-1

Visit www.GEMultilin.com/PQMII to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a PQM II online



Relays and Meters

Metering

Section 22

EPM 9900 Advanced Power Quality Meter

High Performance Power Quality and Transient Recorder Meter

Key Benefits

- Auto-calibrating metrology means the meter maintains its accuracy over temperature and time
- Large memory makes it possible to view years of the circuit's history
- Capture the fastest events with 10MHz transient recording
- Ideal for monitoring industrial power centers, data centers and hospitals due to high accuracy disturbance recording (up to 1024 samples/cycle) and extremely high accuracy 0.06% Watt/Hr metering
- Operators can quickly extract recorded data with download speeds 20 times faster than existing technology
- Flexible communications, modular I/O and field upgradable firmware allow the meter to be easily adapted to changing applications

Applications

- Advanced power quality monitoring
- Revenue class energy and power billing with 0.06% accuracy
- Control of external devices using output modules

Features

Measuring and Metering

- 0.06% Energy Accuracy
- 10MHz Transient Recorder (over 166,000 samples/cycle)
- 8 Channel Waveform Recorder
- Voltage Surge, Sag and Transient Recording
- Current Fault Signatures and Analysis
- Up to 1 GB of Memory
- EN61000-4-30 Class A Support

Communications

- Standard 10/100BaseT Ethernet Port
- Expandable Serial Ports (Dual RS485 Ports)
- Modbus ASCII, Modbus TCP, DNP 3.0 Level 2
- 8 Simultaneous Connections via Ethernet
- Optional Second Ethernet Port
- Up to 16 Relay Outputs
- Up to 40 Digital Status Inputs



Relays and Meters

Metering

Section 22

EPM 9900 Advanced Power Quality Meter

High Performance Power Quality and Transient Recorder Meter
Ordering

PL9900	**	*	*	*	*	**	**	**	Description
Control Power	AC	HI							100 - 240 VAC Power Supply 90-265 VAC or 100-370 VDC
Frequency		6							60 Hz 50 Hz
Current Inputs			5A						5 Amps 1 Amp
Software			1A	A					128 MB memory with 512 samples / cycle 1 GB memory with 1024 samples / cycle 1 GB memory, 1024 samples / cycle + 10MHz Transient Recording
Slot 1				B		S			2-ports RS485 and 4 Pulse Outputs Empty Slot
Slot 2				C		X	E1		Second Ethernet Port, 10/100BaseTX, RJ45
							E2		Second Ethernet Port, 100FX, Multimode, ST connector
							X		Empty Slot
Slot 3							R1		6 Relay Outputs
							D1		16 Status Inputs
							X		Empty Slot
Slot 4							R1		6 Relay Outputs
							D1		16 Status Inputs
							X		Empty Slot

External Output Modules

PL9000	*	*	*	*	*	*	*	0	0	Analog Output Modules
	1	M	A	O	N	4	O			4 Channel 0-1 mA Analog Outputs
	1	M	A	O	N	8	O			8 Channel 0-1 mA Analog Outputs
	2	O	M	A	O	N	4			4 Channel 4-20 mA Analog Outputs
	2	O	M	A	O	N	8			8 Channel 4-20 mA Analog Outputs

PL9000	*	*	*	*	*	*	*	0	0	Analog Input Modules
	8	A	I	1	0	0	0	0	0	8 Channel 0-1mA Analog Inputs
	8	A	I	2	0	0	0	0	0	8 Channel 0-20mA Analog Inputs
	8	A	I	3	0	0	0	0	0	8 Channel 0-5V DC Analog Inputs
	8	A	I	4	0	0	0	0	0	8 Channel 0-10V DC Analog Inputs

PL9000	*	*	*	*	0	0	0	0	0	Digital Output Modules
	4	R	O	1						4 Channel Control Relay Outputs
	4	P	O	1						4 Channel kyz Solid State Pulse Outputs

PL9000	M	B	I	O	0	0	0	0	0	Auxiliary Mounting Bracket (Required for using external modules)
--------	---	---	---	---	---	---	---	---	---	--

PL9000	P	S	I	O	0	0	0	0	0	Auxiliary Power Supply (Must be ordered with external modules)
--------	---	---	---	---	---	---	---	---	---	--

Visit GEDigitalEnergy.com/EPM9900 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 7000 online



Relays and Meters

Metering

Section 22

EPM 9800 Series Power Quality Meter

Precision measurement, advanced communication, advanced PQ and alarm reporting, economical recording meter

Key Benefits

- Socket type mounting design with advanced power quality recording and EN50160 Flicker compliance monitoring
- Revenue class .06% Watt/Hr metering with 20 years time of use calendar
- Comprehensive logging & recording capability
- Auto-calibration and temperature change compensation
- Advanced DNP 3.0 implementation
- High speed waveform recording with programmable 16 to 512 samples per cycle resolution
- Extensive harmonics capability provides a real-time harmonic analysis to the 128th order for every channel. Records THD to the 255th order peak
- Real time phasor analyzer monitors phase angles between the voltage and the currents
- Multiple communication option with 10/100BaseT Ethernet and web capability for data viewing over the web
- Up to 256 expandable digital and analog I/O modules for analysis and control



Applications

- Advanced power quality monitoring
- Revenue class energy and power billing with .06% accuracy
- Control of external devices using I/Os
- Alarm and event notification over the web, email, pager or telephone

Features

Monitoring and Metering

- True RMS real-time power and energy parameters reporting
- 4 quadrant, high accuracy revenue metering
- Automatic dial-out for remote data downloads. Dial-In during outage notification
- Comprehensive events and alarms recording using GPS synchronized time stamps.
- Historical logs for energy, power events and alarms.
- Flicker and waveform recording
- Real-time PQ monitoring and analysis

Communications

- RS 485 communication ports
- Optical port
- Internal ethernet TCP/IP
- Built-in dial-in and dial-out telephone modems
- DNP 3.0 level 2 plus, Modbus RTU and Modbus ASCII protocols
- Multiple analog, digital and relay inputs/outputs
- Programmable LCD display screen



Relays and Meters

Metering

EPM 9800 Series Power Quality Meter

Section 22

Ordering

EPM 9800	*	*	*	*	*	*	Description
PL9800							LCD Graphical Display 2 RS 485 Serial Communication Ports (Modbus & DNP) 8 Internal Digital Inputs, 4 KYZ Pulse Outputs IR Port, IRIG-B Synchronization Port Flicker and Waveform Detection and Logging
Frequency	6						60 Hz
	5						50 Hz
Power Supply		S					Blade Powered - 102 to 550 VAC Auto Ranging
		E					External - 102 - 275 VAC/DC Auto Ranging
		D					External - 18 - 60 VDC Auto Ranging
		L					Blade Powered - 69 VAC
Form		9S					Rated Voltage 0-277 V L-N - 3E, 4W Wye Hook-up
		36S					Rated Voltage 0-277 V L-N - 2.5E, 4W Wye w/ Neutral
		45S					Rated Voltage 0-480 V L-L - 2E, 3W, Delta
		9A					Rated Voltage 0-277 V L-N - A Base Form
		SB					Switchboard - Available with "Power Supply" E and D Only
Logging Options		S					Standard -218 days of data logging, 63 Waveform Record, 1536 Flicker Log, 1024 System Events
		A					Advance -688 days of data logging, 95 Waveform Record, 5120 Flicker Log, 1024 System Events
Communications			R				Standard 2 RS485 serial communications ports (Modbus & DNP)
			W				Web - Standard with Internal 10/100 Base with Web Server and Ethernet Connection
			M				Modem - Standard with Internal 56k Dial Out Modem
			C				Combination - Standard Modem with Ethernet Gateway & Web
CT Secondary				20			5 Amp Phase CT Secondaries - Class 20
				2			1 Amp Phase CT Secondaries - Class 2

Accessories: Analog Output Modules

Note: Accessories must be ordered separately from base meters.

PL9000	*	*	*	*	*	*	*	0	0	Description
	1	M	A	O	N	4	O			4 Channel 0-1 mA Analog Outputs
	1	M	A	O	N	8	O			8 Channel 0-1 mA Analog Outputs
	2	O	M	A	O	N	4			4 Channel 4-20 mA Analog Outputs
	2	O	M	A	O	N	8			8 Channel 4-20 mA Analog Outputs

Analog Input Modules

PL9000	*	*	*	*	0	0	0	0	0	Description
	8	A	I	1						8 Channel 0-1 mA Analog Inputs
	8	A	I	2						8 Channel 4-20 mA Analog Inputs
	8	A	I	3						8 Channel 0-5 VDC Analog Inputs
	8	A	I	4						8 Channel 0-10 VDC Analog Inputs

Digital I/O Modules

PL9000	*	*	*	*	0	0	0	0	0	Description
	4	R	O	1						4 Channel Control Relay Outputs
	4	P	O	1						4 Channel kyz Solid State Pulse Outputs
	8	D	I	1						8 Channel Auxiliary Digital Status Inputs

Auxiliary I/O Mounting

PL9000	M	B	I	O	0	0	0	0	0	Description
										I/O Mounting Bracket (One set per module group)

Auxiliary I/O Power Supply

PL9000	P	S	I	O	0	0	0	0	0	Description
										I/O Auxiliary Power Supply (For more than 4 modules)

9000 Series Meter Display Module

PL9000	*	*	*	*	0	0	0	0	0	Description
	P	4	0	N						Three line LED Display
	P	6	0	N						Touch-Screen LCD Display

9000 Series Meter Software

PL9000	*	*	*	*	0	0	0	0	0	Description
	N	C	M	1						Communicator Software, Single User License
	N	C	M	5						Communicator Software, Five User License
	N	C	M	S						Communicator Software, Multiple User, Single Site License



Relays and Meters Metering

EPM 9000 Series Power Quality Meter

High Performance Power Meter and Data Acquisition Node

Section 22

Key Benefits

- High-performance power quality and revenue class metering for critical power applications
- EN50160 flicker with up to 512 waveform samples per cycle and high-speed transient recording for complete power quality monitoring
- Provides heightened response time to power quality events for diagnostics and maintenance
- Built-in GPS clock sync capability for accurate time stamping of events and alarms for complete synchronized system monitoring
- Exceeds ANSI C-12 and IEC 687 specifications for accuracy with auto calibration using temperature compensation
- Built-in RTU functionality with multiple I/O modules for control
- Software and hardware triggers record waveform events. This allows the unit to be used for fault analysis, system apparatus monitoring and many other applications
- Records THD to the 255th order peak. Real-time harmonic analysis to the 128th order for every channel. This advanced harmonic recording capability has been traditionally available only in high-end power quality recorders
- Real time phasor analyzer monitors phase angles between the voltage and the currents
- Ethernet gateway with web server capability
- Up to 256 expandable I/O points for analysis and control

Applications

- Revenue class metering and load aggregation for energy management
- Transformer loss compensation
- High-performance power quality monitoring of critical loads

Features

Protection and Control

- Fully programmable set-points for alarms and 90 millisecond relay activation for high-speed updates and control
- Built-in PLC & RTU functionality with complete range of expandable external I/Os

Monitoring and Metering

- Current, voltage, real and reactive power, energy use, cost of power, power factor and frequency
- Laboratory grade 0.04% Watt-Hour accuracy
- Flicker and waveform recording
- Real-time PQ monitoring and harmonic analysis to 255th order

Communications

- On-board ethernet and web server capability
- High-speed RS-485 and RS-232 Com Ports
- Multiple protocols including Modbus and DNP 3.0 level 2
- Built-in modem with dial-out capability
- Multiple analog, digital and relay inputs/outputs



Relays and Meters

Metering

EPM 9000 Series

Ordering

Meters

EPM 9450 - High performance power meter & data acquisition node

PL9450	*	*	*	A	*	0	0	0	0	Description
Frequency	0									60 Hz
	1									50 Hz
System Voltage		A								120/208 volts connection
		B								277/480 volts connection
Control Power			0							90-276 volts AC/DC power supply
			1							18-60 volts DC power supply
Features Options				A						Basic unit with 512 K memory, 8 digital inputs, 8 cycle of waveform (up to 512 samples/cycle), 100 days data log.
Communications					0					4 communication port
					1					User-selectable RS 485 Modbus and DNP - no modem or Ethernet connection
					2					TCP/IP Ethernet connection with web server and gateway capability
										Internal 56k modem connection with pass-through port

EPM 9650 - High performance power meter & data acquisition node with memory

PL9650	*	*	*	A	*	0	0	0	0	Description
Frequency	0									60 Hz
	1									50 Hz
System Voltage		A								120/208 volts connection
		B								277/480 volts connection
Control Power			0							90-276 volts AC/DC power supply
			1							18-60 volts DC power supply
Features Options				A						Advance unit includes basic unit, with 2 Meg memory, Up to 162 days of data logging, up to 64 cycles of waveform recording
				B						Flicker includes advance unit plus Flicker with 4 Meg memory, 66 days of data logging
Communications					0					4 Communication port
					1					User-selectable RS 485 Modbus and DNP - no modem or Ethernet connection
					2					TCP/IP Ethernet connection with web server and gateway capability
										Internal 56k modem connection with pass-through port

Accessories

PL9000	*	*	*	*	*	*	*	0	0	Analog Output Modules
	1	M	A	O	N	4	O			4 Channel 0-1 mA Analog Outputs
	1	M	A	O	N	8	O			8 Channel 0-1 mA Analog Outputs
	2	O	M	A	O	N	4			4 Channel 4-20 mA Analog Outputs
	2	O	M	A	O	N	8			8 Channel 4-20 mA Analog Outputs
PL9000	*	*	*	*	0	0	0	0	0	Analog Input Modules
	8	A	I	1						8 Channel 0-1 mA Analog Inputs
	8	A	I	2						8 Channel 4-20 mA Analog Inputs
	8	A	I	3						8 Channel 0-5 VDC Analog Inputs
	8	A	I	4						8 Channel 0-10 VDC Analog Inputs
PL9000	*	*	*	*	0	0	0	0	0	Digital I/O Modules
	4	R	O	1						4 Channel Control Relay Outputs
	4	P	O	1						4 Channel kyz Solid State Pulse Outputs
	8	D	I	1						8 Channel Auxiliary Digital Status Inputs
PL9000	M	B	I	O	0	0	0	0	0	Auxiliary I/O Mounting Bracket (One set per module group)
PL9000	P	S	I	O	0	0	0	0	0	Auxiliary I/O Power Supply (For more than 4 modules)
PL9000	*	*	*	*	0	0	0	0	0	9000 Series Meter Display Module
	P	4	0	N						Three line LED Display
	P	6	0	N						Touch-Screen LCD Display
PL9000	*	*	*	*	0	0	0	0	0	9000 Series Meter Software
	N	C	M	1						Communicator Software, Single User License
	N	C	M	5						Communicator Software, Five User License
	N	C	M	S						Communicator Software, Multiple User, Single Site License



Relays and Meters

Metering

Section 22

EPM 7000 Power Quality Meter

Power Quality and Energy Cost Management

Key Benefits

- Four Quadrant Energy and Power Measurement, complying with ANSI C12.20 (0.2% Accuracy)
- Analyze power quality over long periods of time to improve network reliability through high resolution event and disturbance recording
- Ideal for monitoring industrial power centers, data centers and hospitals due to high accuracy disturbance recording (up to 512 samples/cycle)
- Retrieve archived data, capture past events and analyze disturbances through high resolution data recording (up to 4MB of data logging)
- Flexible communication options provide easy to access meter values, simplified configuration and seamless integration into new or existing automation systems

Applications

- Four quadrant energy and power monitoring of distribution feeders, transformers, reactors and generators
- Power monitoring of LV and MV industrial power control centers and motor control centers
- Energy monitoring of commercial and distribution utilities

Features

Metering

- Meets ANSI C 12.20 and IEC 687 (0.2% Accuracy)
- Ia Ib Ic In
- Va Vb Vc Vab Vbc Vca
- Hz W VAR VA
- Wh VARh VAh
- Demand: W VAR VA
- Power Factor
- Voltage and Current Angles
- Load Bar

Communications

- Standard RS485 Modbus (DNP 3.0 and Modbus RTU or ASCII)
- Optional Ethernet 100BaseT
- IrDA Port
- Intuitive faceplate programming

Power Quality

- Harmonics to the 40th order
- Total Harmonic Distortion
- Disturbance Recording and Waveform Capture
- Sag and Swell

Data Logging

- Up to 4 MB Memory
- Disturbance Recording
- Power Quality Studies
- Load Studies

Software

- Embedded Web Server
- GE Communicator
- EnerVista™ Integrator
- EnerVista™ Launchpad



Metering

EPM 7000 Power Quality Meter

Power Quality and Energy Cost Management

Ordering

PL7000	*	*	*	*	*	*	Description
Frequency	5 6						Standard unit with display, all current/voltage/power/frequency/energy counters measurement, % load bar, RS 485 and IRDA communication ports and one front test pulse output.
Current Inputs		5A 1A					50 Hz AC frequency system 60 Hz AC frequency system 5 Amps 1 Amp
Software			A B C D E F				Multimeter Function Only Data Logging Memory, 2 MB of Memory Power Quality Harmonics, 2 MB of Memory Limits and Control, 2 MB of Memory 64 Samples/Cycle Waveform Recording, 3 MB of Memory 512 Samples/Cycle Waveform Recording, 4 MB of Memory
Power Supply				HI LDC			90-265VAC/100-370VDC 18-60VDC
I/O Modules					X E1 C1 C20 RS1 PS1 F1 F2	X E1 C1 C20 RS1 PS1 F1 F2	None 100BaseT Ethernet* Four Channel Bi-directional 0-1mA Outputs Four Channel 4-20mA Outputs Two Relay status Outputs / Two Status Inputs Four Pulse Outputs / Four Status Inputs Fiber Optic Interface with ST terminations Fiber Optic Interface with Versatile Terminations

* Only one E1 module may be used in the EPM7000

EPM 7000 is available without a display as the EPM 7000T. Please see the online store for ordering information.

Visit GEMultilin.com/EPM7000 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 7000 online



EPM 6010 Building Automation Power Meter

BACnet®/IP Communications and Energy Measurement

Key Benefits

- Rapid integration into BACnet management systems
- High accuracy multifunction power meter, 0.2% class revenue certifiable energy and demand metering
- Ultra compact and easy to install, fits both ANSI and DIN cutouts
- EnerVista™ software makes metered data and power quality status easily accessible
- User programmable for different system voltages and current measurements
- Standard Modbus® TCP communications
- Easy to read, large 3 line .56" bright LED display for better visibility and longer life

Applications

- LEED projects
- Smart buildings
- Commercial energy management
- HVAC efficiency monitoring
- Building management systems

Features

Measuring and Metering

- High accuracy multifunction power meter, 0.2% class revenue certifiable energy and demand metering
- Samples at 400+ times per cycle and has 24 bit A/D conversion to measure accurately and reliably
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) accuracy classes
- Total harmonic distortion (%THD)
- Load percentage graphical bar for instant load visualization
- True RMS multifunction measurements including voltage, current, power, frequency and energy

Communications

- BACnet/IP 100BaseT Ethernet protocol
- 40 pre-defined BACnet objects facilitate rapid integration
- Embedded web-server, allows BACnet/IP interface to be remotely configured and BACnet objects can be remotely viewed over the internet with a web browser
- Standard Modbus TCP communications can be used to poll the EPM 6010 while BACnet/IP interface is being used



Ordering

PL6010	*	*	*	*	Description
Frequency	5	6			50Hz - BACnet/IP Communicating Multimeter 60Hz - BACnet/IP Communicating Multimeter
Current Inputs		5A 1A			5 Amps 1 Amp
Software			THD		THD, Limits Alarms & One KYZ Pulse Output
Power Supply				HI LDC	AC/DC Power Supply (90-265)VAC or (100-370)VDC Low Voltage DC Power Supply (18-60)VDC

Example - EPM 6010 for 60Hz system with 5 Amp secondary and an AC/DC Power supply. PL601065ATHDHI
EPM 6010 is available without a display as the EPM 6010T. Please see the online store for ordering information.



Relays and Meters

Metering

Section 22

EPM 6000 Power Meter

Continuous metering of three-phase systems

Key Benefits

- High accuracy multifunction power meter
- Superior performance at competitive pricing
- Ultra compact, easy to install, program and use
- 0.2% class revenue certifiable energy and demand metering
- Total harmonic distortion (%THD)
- Fits both ANSI and DIN cutout
- Large 3 line .56" bright LED display for better visibility and longer life
- User programmable for different system voltages and current measurements
- Standard Modbus and DNP communications

Applications

- Continuous metering of electrical loads such as generator panels, feeders, switchgear etc.
- Provides remote status when used with EnerVista™ suite of software
- Low and medium voltage applications
- Replaces multiple analog meters saving space and installation costs

Features

Monitoring and Metering

- True RMS multifunction measurements including voltage, current, power, freq., energy, etc.
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) accuracy classes
- Future field upgradeable for added functionality without removing installed meter
- Load percentage graphical bar for instant load visualization

Communications

- RS485 Modbus and DNP 3.0 Protocol up to 57.6K Baud
- 3 Line .56" Bright Red LED Display
- Front IrDA Port laptop communication
- Pulse output for accuracy testing and energy



Ordering

PL 6000	*	*	*	Description
	5			50 Hz AC frequency system
	6			60 Hz AC frequency system
		5A		5 Amps
		1A		1 Amp
			0	No THD option
			THD	THD, Limit Alarms & one pulse Output

Example - EPM 6000 for 60Hz system with 1 Amp secondary current with THD, Limit Alarms & one additional pulse output. PL600061ATHD

Visit www.GEMultilin.com/EPM6000 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 6000 online



Relays and Meters
Metering

EPM 2200 Power Meter
High Accuracy Power and Energy Measurement

Key Benefits

- Economical meter for Circuit Monitoring of Panels, Main Feeds, Branch Circuits, & Gensets
- Ultra compact, easy to install, program and use
- Fits both ANSI and DIN cutout
- Large 3 line .56" bright LED display for better visibility and longer life.
- User programmable for different system voltages and current measurements
- Optional Modbus Communications

Applications

- Monitoring & metering of electrical loads such as generator panels, feeders, switchgear etc.
- Low and medium voltage applications

Features

Monitoring and Metering

- Future field Upgradeable for added functionality (communications option required)
- 0.5% Accuracy
- Measures 3-phase real-time amps and volts
- Optional support for Power, Energy, Frequency, and Power Factor measurements

Communications

- 3 Line .56" Bright Red LED Display
- Intuitive faceplate programming
- Optional RS485 Modbus up to 57.6K Baud and Pulse output



Ordering

PL 2200	*	*	Description
Option	A1 B1 C1		Volts and Amps Meter Volts, Amps, Power and Frequency Volts, Amps, Power, Frequency and Energy Counters
Communications		X S	None RS485 + Pulse

Example1 - EPM 2200 support Voltage and Current measurement with no communications. PL2200A1X
Example 2: EPM 2200 support Voltage, Current, Power, and Frequency measurement and Energy counters measurement with RS485 communication. PL2200C1S



EPM 4500 Sub-Metering System

Multi-tenant digital electric meter with power line communications

Key Benefits

- Multi-point energy demand data logging
- Revenue certifiable metering
- Meets ANSI C12.1 & C12.16 accuracy
- Wall mountable easy-to-install enclosures
- Local LCD viewing
- Communication over existing AC Power Lines (PLC) or Modbus RTU

Applications

- Ideal for commercial, residential and industrial sub-metering applications requiring multi-point energy data logging. This includes multi-point high rise, garden style apartment, condos, or office suites.

Features

Monitoring and Metering

- Real-time per-phase viewing of voltage, current, power factor, phase angle, watts, VARs, VA, and frequency
- Event reporting with time and date stamps regarding power consumption, demand resets, power-ups/power downs, and is available via LCD for viewing

Communications

- PLC Communication (Power Line Communications)
- Modbus RS 485 (optional)
- Up to 48 pulse inputs (optional)
- IEC optical front panel interface for programming



Relays and Meters

Metering

EPM 4500 Sub-Metering System

Section 22

Ordering

The EPM 4500 meter comes standard with Power Line Carrier (PLC) communications protocol. A Transponder is required when using PLC communication. When the Modbus communication modification is selected, no Transponder is required.

Enclosure

Step 1: Select Enclosure

Family	Back Box	Voltage	Options	Description
PL4500	BBA	*	*	Back Box Assembly
		120V		120/208V 3 phase, 4 wire
		208V		208V 3 phase 3 wire
		240V		120/240V, 1 phase, 3 wire
		277V		277/480V 3 phase, 4 wire
		347V		347/600V 3 phase, 4 wire
		480V		480V 3 phase 3 wire
			E	Future Communications Provision

Step 2: Select required meter head

Residential

Residential								
Family	Voltage	Phase	Wires	Application	Metering Points	CTs	Options	Description
PL4500	*	*	*	*	*	*	*	
	120	3	4	R				120/208V 3 phase, 4 wire
					03			3 Points
					06			6 Points
					09			9 Points
					12			12 Points
					24			24 Points
						L		0.1 Amps Secondary Input
						H		5 Amps Secondary Input
							P	Pulse Data Input Module
	240	1	3	R				120/240V, 1 phase, 3 wire
					12			12 Points
					24			24 Points
						L		0.1 Amps Secondary Input
						H		5 Amps Secondary Input
							P	Pulse Data Input Module
	277							277/480V 3 phase, 4 wire
	347							347/600V 3 phase, 4 wire
		3	4	R	24	L		24 points, 0.1 secondary CTs

Commercial 4-Wire

Commercial 4-Wire								
Family	Voltage	Phase	Wires	Application	Metering Points	CTs	Options	Description
PL4500	*	*	*	*	*	*	*	
	120							120/208V 3 Phase
	277							277/480V 3 Phase
	347							347/600V 3 Phase
		3	4	C				3 Phase 4 wire Commercial
					06			6 Points
					08			8 Points
						L		0.1 Amps Secondary Input
						H		5 Amps Secondary Input
							P	Pulse Data Input Module
							M	Modem
							RS	RS485 Connection
							MOD	Modbus Communication

Commercial 3-Wire

Commercial 3-Wire								
Family	Voltage	Phase	Wires	Application	Metering Points	CTs	Options	Description
PL4500	*	*	*	*	*	*	*	
	208							208V 3 phase 3 wire
	480							480V 3 phase 3 wire
		3	3	C	12			12 points
						L		0.1 Amps Secondary Input
							P	Pulse Data Module
							M	Modem
							RS	RS485 Connection
							MOD	Modbus Communication



Relays and Meters

Metering

EPM 4500 Sub-Metering System

Section 22

CT

Type	Description	Product Number
Solid Core - 0.1 A Secondary	CT-50 (50/0.1A)	PLSUBCTSL050
	CT-1 (100/0.1A)	PLSUBCTSL101
	CT-2 (200/0.1A)	PLSUBCTSL201
	CT-4 (400/0.1A)	PLSUBCTSL401
Solid Core - Canadian	CT-2/5DARL (200A/5A)	PLSUBCTSL201CDN
Split Core - 0.1 A Secondary	CTSP-50 (50/0.1A)	PLSUBCTSP050
	CTSP-1 (100/0.1A)	PLSUBCTSP101
	CTSP-2 (200/0.1A)	PLSUBCTSP201
	CTSP-4 (400/0.1A)	PLSUBCTSP401
	CTSP-8 (800/0.1A)	PLSUBCTSP801
	CTSP-12 (1200/0.1A)	PLSUBCTSP1201
	CTSP-20 (2000/0.1A)	PLSUBCTSP2001
	CTSP-30 (3000/0.1A)	PLSUBCTSP3001
	CTSP-40 (4000/0.1A)	PLSUBCTSP4001

Transponder Models

1. Order Back Box

Description	Product Number
120V service back box	TRANS BBA 120V
277V service back box	TRANS BBA 277V
347V service back box	TRANS BBA 347V

2. Order Transponder Model with options

Description	Product Number
120/208V with modem	TRANS120M
120/208V with RS485 and RS232 connections	TRANS120RS
277/480V with modem	TRANS277M
277/480V with RS485 and RS232 connections	TRANS277RS
347/600V with modem	TRANS347M
347/600V with RS485 and RS 232 connections	TRANS347RS

Pulse Inputs

Product Number
PL4500PULSINA
PL4500PULSINB
PL4500PULSINC
PL4500PULSIND



Relays and Meters

Metering

Section 22

EPM 1500 Sub-Metering System

Single-point sub meter with data-logging

Key Benefits

- Revenue certifiable metering
- Meets ANSI C12.1 and C12.16 accuracy
- Local LCD viewing
- Easy to use energy/demand data logging meter, suitable for new construction or retrofit application
- Provides all basic information required for billing purposes
- Power Line Communication (PLC) over the existing power lines. No additional wiring installation is necessary
- Single part number provides a complete package that includes CTs
- Low cost, wall mount simple to use saves installation costs. Rugged metal enclosure is designed for fast installation and is tamper resistant

Applications

- Ideal for commercial and industrial sub-metering applications

Features

Monitoring and Metering

- Real-time per-phase viewing of voltage, current, power factor, phase angle, watts, VARs, VA, and frequency
- Event reporting with time and date stamps regarding power consumption, demand resets, power-ups/downs, and is available via LCD for viewing

Communications

- PLC (Power Line Communications) with transponder
- Modbus Communication via RS485 (options)
- Up to 4 pulse inputs (optional)
- IEC optical front panel interface for programming



Dimensions

Solid Core

50 amp Solid Core CTs:

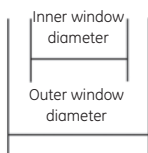
Outer window diameter 1.35"
Inner window diameter 0.60"

100 & 200 amp Solid Core CTs

Outer window diameter 2.7"
Inner window diameter 1.1"

400 amp Solid Core CTs

Outer window diameter 3.56"
Inner window diameter 1.56"



Split Core

50 amp Split Core CTs:

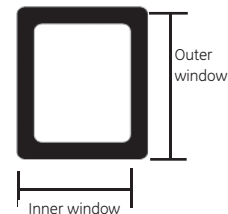
Outer window 2.8" x 3.5"
Inner window 1.8" x 1.3"

100, 200 & 400 amp Split Core CTs:

Outer window 4.9" x 4.3"
Inner window 3.5" x 2.4"

800 amp Split Core CTs:

Outer window 7.3" x 5.9"
Inner window 5.0" x 3.0"



Meter Dimensions

13.5"H x 8.5"W x 4.5"D



Relays and Meters

Metering

EPM 1500 Sub-Metering System

Section 22

Ordering

The EPM 1500 meter comes standard with Power Line Carrier (PLC) communications protocol. A Transponder is required when using PLC communication. When the Modbus communication modification is selected, no Transponder is required.

EPM 1500 Without CTs

Family	Voltage	Version	CTs	Delta	Options	Description
PL1500	*	*	*	*	*	
	120					120/208V 3 phase
	277					277/480V 3 phase
	347					347/600V 3 phase
		K				KWh version
		D				Demand version
			L			0.1 amps CT secondary input
			H			5 amps CT secondary input
				P		Pulse data module
				MOD		Modbus communications
	480					480V Delta
	600					600V Delta
		D				Demand version
			L			0.1 amps CT secondary input
			H			5 amps CT secondary input
				DTA		Delta 3P3W
				P		Pulse data module
				MOD		Modbus communications

EPM 1500 With CTs

Family	Voltage	Version	CTs	Option	Description
PL1500	*	*	*	*	
	120				120/208V 3 phase
	277				277/480V 3 phase
	347				347/600V 3 phase
		K			KWh version
		D			Demand version
			SP050		Split core 50A CTs - set of 3
			SP100		Split core 100A CTs - set of 3
			SP200		Split core 200A CTs - set of 3
			SP400		Split core 400A CTs - set of 3
			SP800		Split core 800A CTs - set of 3
			SP3200		Split core 3200A CTs - set of 3
			SL050		Solid core 50A CTs - set of 3
			SL100		Solid core 100A CTs - set of 3
			SL200		Solid core 200A CTs - set of 3
			SL400		Solid core 400A CTs - set of 3

CTs

Type	Description	Product Number
Solid Core - 0.1 A Secondary	CT-50 (50/0.1A)	PLSUBCTSL050
	CT-1 (100/0.1A)	PLSUBCTSL101
	CT-2 (200/0.1A)	PLSUBCTSL201
	CT-4 (400/0.1A)	PLSUBCTSL401
Solid Core - Canadian	CT-2/5DARL (200A/5A)	PLSUBCTSL201CDN
	CTSP-50 (50/0.1A)	PLSUBCTSP050
Split Core - 0.1 A Secondary	CTSP-1 (100/0.1A)	PLSUBCTSP101
	CTSP-2 (200/0.1A)	PLSUBCTSP201
	CTSP-4 (400/0.1A)	PLSUBCTSP401
	CTSP-8 (800/0.1A)	PLSUBCTSP801
	CTSP-12 (1200/0.1A)	PLSUBCTSP1201
	CTSP-20 (2000/0.1A)	PLSUBCTSP2001
	CTSP-30 (3000/0.1A)	PLSUBCTSP3001
	CTSP-40 (4000/0.1A)	PLSUBCTSP4001

Transponders

1. Order Back Box

Description	Product Number
120V service back box	TRANS BBA 120V
277V service back box	TRANS BBA 277V
347V service back box	TRANS BBA 347V

2. Order Transponder Model with options

Description	Product Number
120/208V with modem	TRANS120M
120/208V with RS485 and RS232 connections	TRANS120RS
277/480V with modem	TRANS277M
277/480V with RS485 and RS232 connections	TRANS277RS
347/600V with modem	TRANS347M
347/600V with RS485 and RS 232 connections	TRANS347RS

Pulse Modules

Description	Product Number
KYZ Pulse output option	PL1500 KYZ
Input module for 4 pulse inputs	PL1500PULSIN10



Relays and Meters
Metering

EPM 7100 Power Quality Meter
Energy and Demand Submeter with Data Logging and WiFi

Key Benefits

- Flexible WiFi option eliminates the need for expensive wiring
- 0.2% accurate revenue class meter provides highly reliable measurements
- Extensive data logging and alarm recording allows for predictive maintenance and performance analysis
- Multifunction capability allows a variety of voltage, current and energy metering measurement
- Direct interface with most building management systems reduces integration costs
- Easy installation reduces set-up time and cost
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) classes

Applications

- Allocate energy usage throughout multi-tenant settings, such as industrial and university campuses, office towers, apartment complexes and shopping malls
- Detect power problems early in government, military and airport facilities
- Energy monitoring to increase OEMs efficiency

Features

Metering

- Ia Ib Ic In
- Va Vb Vc Vab Vbc Vca
- Hz W VAR VA
- Wh VARh VAh
- Demand: W VAR VA
- 2MB of Data Logging Capacity
- Power Factor
- Voltage and Current Angles
- Bright Red LED Display with Three .56" Lines
- % of Load Bar for Analog Meter Perception

Communications

- Standard RS485 Modbus (Modbus RTU or ASCII)
- IrDA Port
- Optional Ethernet 10/100BaseT or WiFi
- Intuitive Faceplate Programming



Ordering

PL7100	*	*	*	*	*	Description
Frequency	5 6					Standard Unit with display. All current/voltage/power/energy counters measurement, % load bar, RS485 and IrDA ports and one front test pulse output. 2 MB of data logging memory. 50 Hz AC Frequency System 60 Hz AC Frequency System
Current Inputs		5A 1A				5 Amps 1 Amp
Software			B			Multifunction Meter with 2MB Data Logging
Power Supply				HI		90-400 VAC / 100-370 VDC
I/O Modules					S W	Serial Port Communication Wireless or LAN Based Ethernet

Visit GEDigitalEnergy.com/EPM7100 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 7100 online



Metering

EPM 6100 Power Quality Meter

Energy and Demand Submeter with WiFi

Key Benefits

- Flexible WiFi option eliminates the need for expensive wiring
- 0.2% accurate revenue class meter provides highly reliable measurements
- Multifunction capability allows a variety of voltage, current and energy metering measurements
- Direct interface with most building management systems reduces integration costs
- Easy installation reduces set-up time and cost
- Meets ANSI C12.20 (0.2%) and IEC 687 (0.2%) classes

Applications

- Allocate energy usage throughout multi-tenant settings, such as industrial and university campuses, office towers, apartment complexes and shopping malls
- Detect power problems early in government, military and airport facilities
- Energy monitoring to increase OEMs efficiency

Features

Metering

- Ia Ib Ic In
- Va Vb Vc Vab Vbc Vca
- Hz W VAR VA
- Wh VARh VAh
- Demand: W VAR VA
- Total Harmonic Distortion
- Power Factor
- Voltage and Current Angles
- Bright Red LED Display with Three .56" Lines
- % of Load Bar for Analog Meter Perception

Communications

- Standard RS485 Modbus (Modbus RTU or ASCII)
- IrDA Port
- Optional Ethernet 10/100BaseT or WiFi
- Intuitive Faceplate Programming



Ordering

PL6100	*	*	*	*	*	Description
Frequency	5					Standard Unit with display. All current/voltage/power/energy counters measurement, % load bar, RS485 and IrDA ports and one front test pulse output.
	6					50 Hz AC Frequency System
Current Inputs		5A				60 Hz AC Frequency System
		1A				5 Amps
			0			1 Amp
Software			THD			No THD Option
				HI		With THD and Limit Alarms
Power Supply						90-400 VAC / 100-370 VDC
I/O Modules					S	Serial Port Communication
					W	WiFi Wireless or LAN Based Ethernet

Visit GEDigitalEnergy.com/EPM6100 to:

- View Guideform Specifications
- Download the instruction manual
- Review applications notes and support documents
- Buy a EPM 6100 online



Relays and Meters

Metering

GE Meter in a Box (MIB)

Key Benefits

- Ease of ordering – all necessary components to interface with a meter included
- Internal wiring completed for you, just connect your wires to the terminal board – reduced risk of wiring mistakes and accelerated installation.
- Small enclosure profile allows for increased flexibility when choosing a mounting location.
- Elementary diagrams are available in electronic format... or ask GE for a quote to update your drawing.
- UL/CUL listed.
- Optional: customer-specified meter (GE Multilin™, Schweitzer, Other).

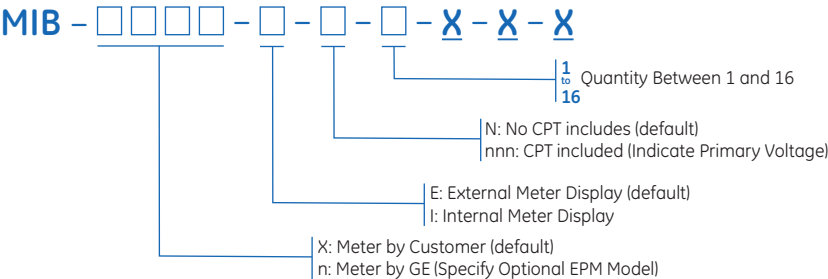
Product Description (Subject to change without notice)

NEMA Rating	Type 12 or Type 4*
Device Rating	Wiring and power terminal block rated for 600V
Dimensions	12" wide x 16" high x 8" deep (Metric: 305 mm x 406 mm x 203 mm)
Latch	Pad Lockable hasp
Wiring	Wired for 3, 4-wire applications: CT shorting terminal block, fused voltage disconnect, control power, and 12 pt. input/output TB.
Optional Features	Control Power Transformer – Provides 50 VA control power supply where monitored voltage is above 265 VAC Internal Hinged Meter Display – preserves NEMA 4 rating if panel is otherwise properly installed Meter – Shown with Optional GE Multilin EPM

* Internal Display Option Only



Ordering

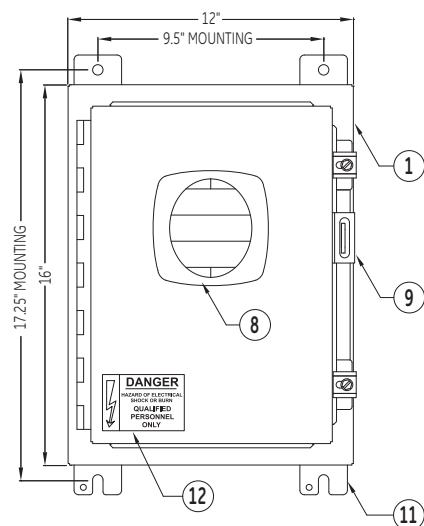


Relays and Meters

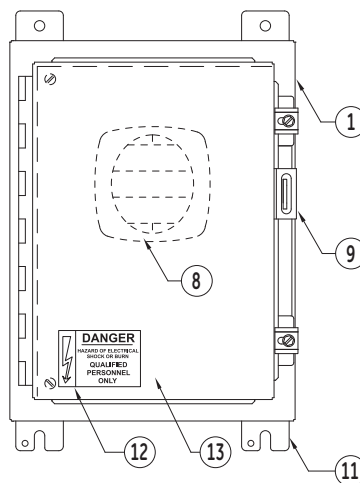
Metering

GE Meter in a Box (MIB)

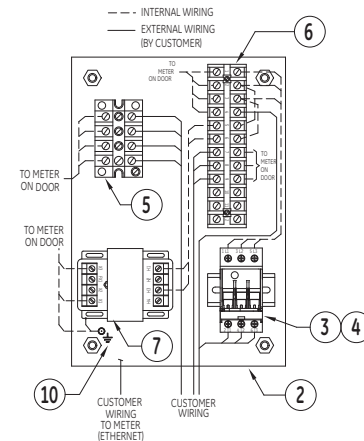
Section 22



MIB-EPM Style 01W
with External Meter Display



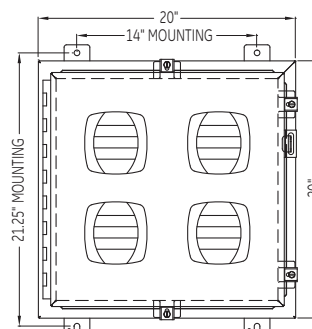
MIB-EPM Style 01W
with Internal Meter Display



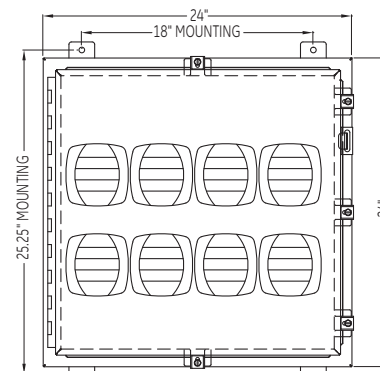
MIB-EPM Style 01W
Internal Wiring

Item # (from drawings)	Standard Component Description <i>Subject to change without notice</i>
1	ENCLOSURE
2	SUBPANEL
3	FUSE BLOCK (FINGER SAFE)
4	FUSES
5	4PT. SHORT CIRCUIT TERMINAL BLOCK
6	12PT. TERMINAL BLOCK
7	CP TRANSFORMER
8	EPM METER LOCATION (METER SUPPLIED SEPARATELY)
9	HASP STYLE DOOR LOCK (CUSTOMER PADLOCK)
10	GROUND
11	ENCLOSURE MOUNTING
12	DANGER, CAUTION, UL LISTED & SERIAL # LABELS
13	OPTION: HINGED METER SUBPLATE FOR INTERNAL METER DISPLAY

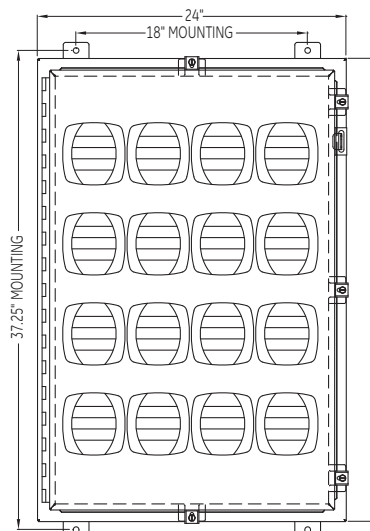
For pricing and details,
contact your local
GE representative
or call 1 (888) GE4-Serv



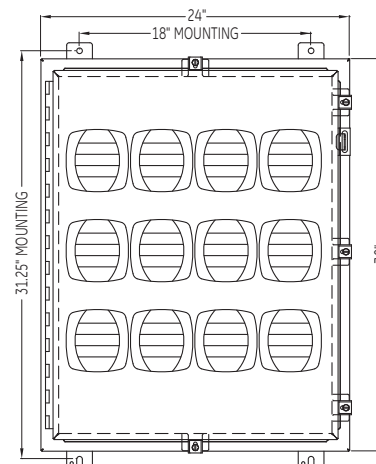
Style 04W
(2 to 4 Meters)



Style 08W
(5 to 8 Meters)



Style 16W
(13 to 16 Meters)



Style 12W
(9 to 12 Meters)



Relays and Meters

Communications

Multiplexers

Section 22

[Multiplex Family Overview](#)

[page 22-171](#)

GE Multilin™ offers a full suite of highly reliable Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) optical communication multiplexers. These include the JungleMUX SONET Multiplexer, the TN1U SDH Multiplexer and the TN1Ue SDH Multiplexer. Lenronics Multiplexers are designed for electric power utility, transportation, oil, gas, water and industrial applications. This powerful family of fiber optic multiplexers has a modular design for ease of maintenance, configuration flexibility and expandability.

[JungleMUX™ Sonet Multiplexer](#)

[page 22-174](#)

OC-1/OC-3/OC-12stem

The JungleMUX™ SONET Multiplexer delivers robust SONET telecommunications for wide area communication applications that requires a mix of proprietary and legacy standards based optical communications equipment.

[JungleMUX™ T1 Multiplexer](#)

[page 22-174](#)

OC-1/OC-3/OC-12stem

The JungleMUX™ T1 Multiplexer delivers robust wide area networking over T1 leased lines for communication applications that requires a mix of proprietary and legacy standards based optical communications equipment.

[TN1U SDH Multiplexer](#)

[page 22-175](#)

STM-1/STM-4

The TN1U SDH Multiplexer delivers the benefits of the ITU-T SDH telecommunications standards to Ethernet solutions as well as applications previously serviced by a mix of proprietary and legacy standards based optical communications equipment.

[TN1Ue SDH Multiplexer](#)

[page 22-175](#)

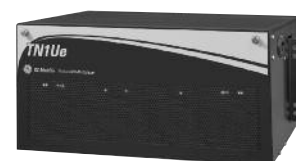
STM-1/STM-4

The TN1Ue SDH Multiplexer delivers the benefits of the ITU-T SDH telecommunications standards to Ethernet solutions as well as applications previously serviced by a mix of proprietary and legacy standards based optical communications equipment. The enclosed shelf design provides additional security in sensitive Electromagnetic interference (EMI) environments.

[VistaNET™ Network Management System \(NMS\)](#)

[page 22-176](#)

For a more flexible NMS, VistaNET™ can be provisioned as a standalone or a client-server LAN/WAN solution, permitting centralized or distributed network management.



Multiplexer Family Telecommunication Multiplexers

Versatile, reliable and rugged solutions for fiber optic, microwave radio and leased line networks

Applications

Electric Utility

- Ethernet WAN/IP
- Protective relaying
- Substation automation
- Telemetry/SCADA
- Voice
- Video surveillance

Transportation

- Video surveillance
- Toll collection
- Traffic monitoring and control
- Emergency voice
- Signaling
- Loop detection
- Variable message signs (VMS)

Pipeline

- Oil, gas, refined products, water, slurry
- Leak detection
- Hydraulic control
- Pipeline SCADA
- Video surveillance
- Ethernet WAN/IP
- Voice

Industrial

- Oil and gas production field SCADA
- Mining and petrochemical plant electric distribution network protection and control
- Energy management
- Ethernet WAN/IP
- Video surveillance
- Video process monitoring



Relays and Meters Communications

Multiplexer Family Telecommunication Multiplexers

Section 22

Unit Assembly Description

JungleMUX/TN1U/TN1Ue

Data Interface Units	
Low Speed Data	B86448
<ul style="list-style-type: none"> • RS232 interface • Sub-rate multiplexing • Point-to-point and multi-point 	
High Speed Data	B86446
<ul style="list-style-type: none"> • 64 kb/s (56 kb/s) rates • RS422, V.35 and G.703 interfaces 	
Nx64 kb/s Data Electrical	B86464
<ul style="list-style-type: none"> • N x 64 kb/s channels (N=1 to 12) • V.35 interface 	
DS-1 (1.54 Mb/s) Data	B86437
E-1 (2.048 Mb/s) Data	B86439
DS-3 (44.7 Mb/s) Data	B86491
<ul style="list-style-type: none"> • Establishes full duplex point-to-point DS-3 circuit • Drop equipment connections for DACS, M13 multiplexer or any other DS-3 terminating equipment 	
Ethernet	B86438/B86418
<ul style="list-style-type: none"> • IP connectivity • LAN/WAN interconnect • 10/100 Mb/s learning bridge • Intelligent multi-port switch features • IEEE 802.1Q, 802.1p, 802.1d, 802.1u 	
Voice Units	
4 Wire Voice Frequency	B86444
<ul style="list-style-type: none"> • Optional E&M signaling • Point-to-point and multi-point 	
2 Wire Voice Frequency	B86449
<ul style="list-style-type: none"> • Optional E&M signaling 	
2 Wire Foreign Exchange	B86445
<ul style="list-style-type: none"> • Loop or ground start signaling 	
2 Wire Foreign Subscriber	B86445
<ul style="list-style-type: none"> • Remote PABX extension 	
Video Units	
Video Mapper 10	B86411
<ul style="list-style-type: none"> • Provides video WAN of 12 Mb/s 	
Video Mapper 40	B86410
<ul style="list-style-type: none"> • Provides video WAN of 48 Mb/s 	
Video Input/Output	B86412
<ul style="list-style-type: none"> • NTSC or PAL analog video signal transport • MPEG-4 compression options • 56 kb/s to 10 Mb/s bandwidth • 1 to 30 frames/second update rate • PTZ camera control • Stereo quality audio • Data & control I/O 	
Remote Video Assembly	B86414



Unit Assembly Description

JungleMUX/TN1U/TN1Ue

Teleprotection Units	
Transfer Trip	B86441/B86442
<ul style="list-style-type: none"> • Separate transmit and receive units • Optional test panel 	
Current Differential Relay	B86443
<ul style="list-style-type: none"> • Various pilot wire relay interfaces 	
Nx64 kb/s Data Optical	B86464
<ul style="list-style-type: none"> • N x 64 kb/s channels (N=1 to 12) • IEEE C37.94 compliant, standard for fiber optic connection to protective relays 	
Additional Units	
Contact Input/Output	B86463
<ul style="list-style-type: none"> • Transport of contact closure 	
Orderwire	B86471
<ul style="list-style-type: none"> • Party line voice circuit carried on 64 kb/s channel of either transport or path overhead • DTMF signaling 	
Channelized T1	B86486
<ul style="list-style-type: none"> • Access remote T1 networks at DSO level • Extend JungleMUX networks across microwave radio, leased lines foreign SONET networks • Provides cross-connect capability at JungleMUX SONET network edge 	



Jungle MUX SONET Multiplexer

The ideal optical networking solution for electric utility, transportation, pipeline and industrial applications

Key Benefits

- Functions as a SONET OC-1, OC-3 or OC-12 drop-and-insert multiplexer with up to 672, 2016, or 8064 DS-0 channel drop capacity
- Robust environmental design
- Supports point-to-point, linear add/drop, ring and multiple ring plus spur network topologies
- Extremely fast path protection switching (<3 ms)
- 1310 nm and 1550 nm optical interfaces available
- Economically scalable for all sizes of networks and sites with varying service requirements
- System expansion, reconfiguration and maintenance are easily performed with a minimum of system downtime, travel expense and test equipment
- Improves reliability through integration of all network requirements into a common package
- NMS allows visibility of network traffic down to each individual DS-0 signal
- Allows common NMS integration using IP
- Optional video control system package
- Optional SNMP Network Management System (NMS) interface

Application Modules

- Ethernet WAN/IP
- Video, voice, data and teleprotection
- DS-1, DS-3
- Digital telemetry and orderwire
- Channelized T1



Jungle MUX T1 Multiplexer

Versatile, reliable and rugged solution to extend telecommunication applications over fiber optic, microwave radio and leased line networks

Key Benefits

- T1 Multiplexer with integrated digital cross connect
- Environmentally hardened – meets IEEE 1613 specifications including SWC, RFI and ESD requirements
- Hot swappable units
- Multiple configurations:
 - Terminal Multiplexer
 - Add/Dropp Multiplexer
 - Cross Connect (DAX)
- Supports full duplex 1.544 Mb/s channelized T1 circuits (ITU-T G.703 compliant)
- Wide range of DS0 applications – common interface units with JungleMUX SONET Multiplexers
- Multiple powering options
- Local and remote configuration via existing VistaNET™ network management tools
- Optional redundant control and T1 line unit (CDAX Unit)

Application Modules

- Voice
- Data
- Teleprotection
- Digital telemetry
- Power: 24/48/130 VDC, 115 VAC



TN1U SCH Multiplexer

The ideal optical networking solution for electric utility, transportation, pipeline and industrial applications

Key Benefits

- Functions as an STM-1/STM-4 drop-and-insert multiplexer with up to 252 VC-12 drop capability
- Robust environmental design
- Supports two fibre linear applications, self-healing D-P rings, multiple rings and rings plus spurs
- Supports multiple STM-1 or STM-4 rings interconnected through synchronous TIE links
- Extremely fast path protection switching (<3 ms)
- 1310 nm and 1550 nm optical interfaces available
- Economically scalable for all sizes of networks and sites with varying service requirements
- System expansion, reconfiguration and maintenance are easily performed with a minimum of system downtime, travel expense and equipment
- Improves reliability through integration of all network requirements into a common package
- NMS allows visibility of network traffic down to each individual 64 kb/s channel
- Optional video control system package
- Optional SNMP Network Management System (NMS) interface

Application Modules

- Ethernet WAN
- Video, voice, data and teleprotection
- Channelized E1
- Digital telemetry and orderwire



TN1UeSDH Multiplexer

Key Benefits

- Functions as an STM-1/STM-4 drop-and-insert multiplexer with up to 252 VC-12 drop capability
- Robust environmental design
- Utility hardened
- Supports two fibre linear applications, self-healing D-P rings, multiple rings and rings plus spurs
- Supports multiple STM-1 or STM-4 rings interconnected through synchronous TIE links
- Extremely fast path protection switching (<3 ms)
- 1310 nm and 1550 nm optical interfaces available
- Economically scalable for all sizes of networks and sites with varying service requirements
- System expansion, reconfiguration and maintenance are easily performed with a minimum of system downtime, travel expense and equipment
- Improves reliability through integration of all network requirements into a common package
- NMS allows visibility of network traffic down to each individual 64 kb/s channel
- Optional video control system package
- Optional SNMP Network Management System (NMS) interface



Application Modules

- Ethernet WAN
- Video, voice, data and teleprotection
- Channelized E1
- Digital telemetry and orderwire



VistaNET™ Network Management System (NMS)

VistaNET™, the next generation of software tools to manage GE Multilin™'s JungleMUX SONET and T1, TN1U and TN1Ue SDH Multiplexers

Key Benefits

- Remote configuration, monitoring and testing of all common equipment and telecommunication service interface units at any node in the system, minimizes disruption and maintenance costs
- Simultaneous configuration and monitoring by more than one user, distributes network administration and maintenance responsibilities
- Time stamped logging of alarms and intelligent processing of alarm lists, assists in identifying hard-to-find problems, facilitates alarm acknowledgement and provides immediate update on current system status
- Recording of network configuration changes provides an audit trail for future reference
- Single integrated system view for interconnected and discrete network segments simplifies management
- Security is enhanced through a multi-level password and privilege system with automatic expiration interval, controlled by a system administrator
- Optical status information and BER statistics provide preliminary indications of system level problems, such as fiber cable and equipment component degradation



VistaNET™ Components

- VistaNET™ Local Access (VLA) is a thrifty, rudimentary NMS solution ideal for small networks
- VistaNET™ Network Interface (VNI) is the standard NMS offering, providing remote configuration and monitoring of Lentrionics Multiplexer optical networks
- VistaNET™ Serial Communication Port Expansion is a RTU license offered for each additional VNI serial communication port connection privilege. This license is required when further redundancy is needed, or a new network segment is added to the system
- VistaNET™ Server Application (VSA) provides a single instance RTU license for the VistaNET™ server gateway application to run on a Windows 2000, NT or XP PC or LAN server computer
- IP Service Unit (IPSU) is the IP version of the JungleMUX service unit, but contains an embedded computer and server gateway software package, as well as a TCP/IP Ethernet connection for NMS access
- VistaNET™ SNMP Agent (VSNMP). Enhances any VistaNET™ service with SNMP functionality. When enabled, the VistaNET™ session converts VistaNET™ alarms into SNMP traps (ver1.0 and/or 2.0) and forwards them to a user-defined list of SNMP managers (via UDP/IP). The agent supports GET commands of Active and Clear alarms

Visit www.GEMultilin.com/VistaNET to:

- Log into User website
- Download software
- Request more information
- View Multiplexer brochures



VistaNET™ Network Management System (NMS)

Ordering

VistaNET™ Network Interface (VNI)	8645-01
<ul style="list-style-type: none"> • Standard NMS offering • Remote configuration and monitoring of rings, nodes and units • Provides two serial communication port connection privileges from a PC or laptop to network segments • VistaNET™ Local Access (VLA) RTU license included • Provides for VNI client functionality in client-server TCP/IP Ethernet NMS implementation 	
VistaNET™ Local Access (VLA)	86456-02
<ul style="list-style-type: none"> • Thrifty, rudimentary NMS offering for small networks • Local configuration and troubleshooting of units • Remote monitoring of rings, nodes and units • RTU license per node • Provides two serial communication port connections privileges from a PC or laptop to network segments and local units • Included with VNI RTU license 	
VistaNET™ Upgrade from JNCI/TNCI	86456-03
<ul style="list-style-type: none"> • License for upgrading from JNCI/TNCI to VistaNET 	
VistaNET™ Server Application (VSA)	86456-04
<ul style="list-style-type: none"> • Creates client-server TCP/IP Ethernet NMS environment for a network segment • Provides server gateway functionality from a PC or LAN server computer, when a NMS serial communications port connection to a network segment is required • Provides one serial communication port connection privilege to the network segment and up to three TCP/IP Ethernet connection privileges for VNI clients • Single instance of VSA required for each serial communications port connection to a network segment • RTU license per instance of VSA • Each VSA instance supports up to 50 nodes 	
VNI Serial Communication Port Expansion	86456-05
<ul style="list-style-type: none"> • RTU license for one additional VNI serial communication port connection privilege to a network segment 	
VNI Serial Communication Port Expansion	86456-06
<ul style="list-style-type: none"> • Provides SNMP functionality 	
IP Service Unit (IPSU)	B86434-03
<ul style="list-style-type: none"> • Downloadable option selectable from website • Each IPSU supports up to 25 nodes • Multiple IPSUs per network segment provide redundancy 	
Equipped with VistaNET™ Server Package	84634-51 (Downloadable)
<ul style="list-style-type: none"> • Creates client-server TCP/IP Ethernet NMS environment (downloadable) for a network segment • VSP server gateway functionality embedded within IPSU • Provides up to three TCP/IP connection privileges for VNI clients 	
Equipped with SNMP Support Package	86434-61 (Downloadable)
<ul style="list-style-type: none"> • Provides UDP/IP Ethernet NMS connection from a network (downloadable) segment to a third-party SNMP Manager 	

Ordering

To order GE Multilin™ Multiplexer Family products please refer to the sales offices listing at the back of the catalog. Any individual contact listing with the annotation (T) for Telecommunications, can provide you with product and pricing information.



MDS Mercury 900™ - License-free Industrial Broadband



Multimegabit Industrial Mobility Solutions

Multi-megabit speed and long range allows multiple services on one infrastructure. The Mercury 900™ is an industrial wireless Ethernet solution with advanced cyber-security. Featuring Quality of Service, Mercury can be optimized for your specific application, whether mobile data, video surveillance, VoIP, or SCADA polling, or multiple applications on the same network.

MDS NETio™ - Wireless Analog and Discrete I/O



Tremendous Flexibility and Expandability Dramatically Extends Industrial Networking

Align your throughput and distance requirements with the most uniquely scalable wireless solution—the MDS NETio™. Reduce wiring and termination costs between controllers and remote I/O points. The NETio regenerates I/O signals or can carry serial and or IP/Ethernet payload and I/O. Address the I/O directly with protocols including Modbus, Modbus TCP, DNP.3 and more. Expansion modules and wireless expansion (WeXP) permit accommodation of a user's I/O count and distance requirements.

MDS iNET-II 900™ - 1 Mbps, License-free



The Industry Leader At Megabit Speeds

Megabit speed, exceptional range, and enhanced security are the benefits of the MDS iNET-II 900™. Industrial-grade performance allows the iNET-II to function robustly in extended temperature ranges and in more extreme environments, while Ethernet and serial interfaces permit the smooth migration of existing or legacy serial devices to IP networks. The iNET-II is well suited to both fixed and mobile applications and provides the lowest cost of ownership.

MDS iNET 900™ - License Free



The Standard-Bearer for Industrial Wireless License-Free Networking

The longest-range high-speed industrial wireless solution in its class, the MDS iNET 900™, offers multiple layers of cyber security and industrial-grade performance. Offering robust operation in greater temperature ranges and more extreme environments, the iNET delivers both Ethernet and serial interfaces and enables the smooth migration of existing serial devices into an IP network.

MDS entraNET™ at 900 MHz and 2.4 GHz and the EZ Remote



Extended Range IP Networking

The MDS entraNET 900™ is an exceptionally long-range frequency hopping wireless solution, offering robust performance in extreme environmental conditions while keeping power consumption low and data rates high. Both serial and Ethernet devices can communicate in peer-to-peer mode and connect to an IP network—all with multiple layers of cyber security. The end result is reduced cost of deployment for systems that bring mission-critical, revenue-generating data from assets such as oil and gas wells, compressor stations, pipelines, and fluid storage tanks over Ethernet or a serial gateway and onto IP-based networks.



Wideband License-Free Point to Point

MDS FIVE.8™ - License-free, Scalable to 100 Mbps and Multiple T1/E1s



Highly Efficient High-Speed Backhaul Solutions

The MDS FIVE.8™ balances exceptional system gain with outstanding spectral efficiency and channel availability to provide the best overall network connectivity in the industry. Self-healing redundancy makes the FIVE Series more reliable than traditional point-to-point networks, and automatically adjusts transmit power in response to interference, simplifying deployment and network management. The FIVE.8 can be used for network aggregation, backhaul or to extend an existing network.

Wideband Licensed Point to Point

MDS LEDR™ - 400 MHz, 900 MHz and 1.4 GHz Licensed Point-to-Point Solutions



Scalable, Secure Backhaul Solutions

These radios are designed to operate in a point-to-point environment with a wide range of applications. They are especially effective for telecommunications access and transport links, wireless backbones for SCADA systems, and for use as backhaul to extend existing telecommunication channels.

LEDR Subrate Series

The Subrate LEDR™ microwave radio family provides full duplex, scalable bandwidth, and capacity from 64 kbps to 768 kbps in a 200 kHz channel. The Subrate LEDR is designed to connect to any industry standard EIA-530, V.35, fractional T1 or E1 source. Available in protected configurations with front panel displays, integrated HTML web servers, and SNMP Network Management systems, these radios offer easy management and monitoring of your entire wireless network.

LEDR Full Rate Series

The Full Rate LEDR™ microwave radio family provides full duplex, scalable bandwidth, and capacity from 1 X E1 (2.048 Mbps) in a 500 kHz channel up to a 4 X E1 (8.192 Mbps) in a 2 MHz channel. The Full Rate LEDR is designed to connect to any industry standard E1 G.703 source.

Narrowband Licensed Point to Multipoint

MDS Transceiver Series x710



The Long-Range Industry Workhorse

The MDS x710 Transceiver Series is a price/performance leader for licensed radios in the 220-222 MHz, 220-240 MHz, 330-512 MHz, and 800-960 MHz frequency ranges. These radios provide excellent throughput and exceptional range for a wide variety of multiple address systems. Transparent, direct asynchronous communication offers real-time communications capabilities, and no additional software or programming is necessary to implement solutions using standard asynchronous protocols. With its exceptional design, the Transceiver Series offers excellent performance—even when confronted with interference or challenging signal paths.

MDS Master Station Series x790



New Standards for Excellence

The MDS Master Station Series is available in the 330-512 MHz and 800-960 MHz frequency ranges, and may be configured for full duplex, half-duplex or simplex operation. Available in a number of redundant configurations, the Master Station Series radio is configurable as a master station or remote radio. The Master Station also delivers increased throughput and longer-range alternatives for Multiple Address Systems needs.



MDS TransNET 900™ and MDS TransNET 2400™



Reliable Serial Communications for Complex SCADA Requirements

Today's SCADA/Telemetry systems require the transmission of large amounts of data at ever increasing speeds. The MDS TransNET 900™ is an extremely flexible serial radio, offering frequency hopping operation and data rates as high as 115.2 kbps. Featuring a sleep mode that is well suited to solar-powered applications, store and forward capabilities and unparalleled robustness, the TransNET sets new standards for reliable, long-range wireless data transmission.

Other MDS Products

MDS SCADAcrypt™ —Protect Your Critical Serial Data with AES 256 Bit Encryption

Legacy Networks, Munitions-Grade Security

The MDS SCADAcrypt™ secures your entire wireless network from the originating device to the host on point-to-point or point-to-multipoint links. Strengthen security at your own pace by adding new units as needed; a single command from the web server interface enables system-wide security. Simple, reliable, impenetrable.

MDS InSite™ and MDS NETview™—Proactive Network Management and Diagnostics

Wireless Networking@Your Command

MDS InSite™ is designed for comprehensive field diagnostics or daily monitoring from a central location. The MDS NETview MS™ uses the SNMP industry standard protocols and allows performance monitoring, configuration, and control of MDS equipment and other SNMP devices.

Spectrum Leasing

Leasing Options for Robust Solutions and Rapid Deployment

MDS 900 MHz Licensed Channels for lease allow immediate deployment of an MDS Licensed network. Ask us about leasing arrangements for rapid solutions deployment.

Accessories

A Full Range of Wireless Products

Additional wireless solutions include: MDS Packaged Radios, the OEM series, licensed point to multipoint IP radios, MDS Multiplexers and the MDS ClearWave™ Antennas.

Multilink Ethernet Communication Switches

Ethernet Communications for Industrial Automation, Power Utility, and Traffic Control markets

Key Benefits

The MultiLink family is a line of Industrial and Substation Hardened Ethernet Switches that will provide you with secure, reliable communications with all of your critical infrastructure devices. Designed to meet the unique requirements of the Protection and Control Industry the MultiLink Ethernet Switches will ensure your communications network is always available, even under the worst environmental and transient conditions.

Ability to Withstand Harsh Environments

- IEC61850-3 compliant for harsh substation environments
- IEEE 1613 Class 2 compliant for transient immunity
- IP 40 rated for environmental protection
- -40°C to +85°C Operating temperature without fans

High Degree of Network and Management Security

- SNMPv3 Encryption
- Secure Web Management
- Remote Access Security
- Radius & TACACS+ for secure password authentication

Enhanced Reliability with Fast Fault Recovery

- Network Ring Recovery of less than 5ms per switch
- Link-Loss-Alert for detecting broken 10Mbit & 100Mbit fiber connections
- Redundant power supplies with mixed inputs voltages available

Simple Switch Configuration and System Integration

- Powerful web interface for entire switch configuration
- Enhanced web statistics simplifying troubleshooting
- Modbus TCP/IP support for Monitoring & System Integration

Support of all Common Network Communication Ports

- 10Mbit, 100Mbit, 1000Mbit Ports
- ST, SC, LC, and MTRJ Multimode and Singlemode Fiber Optics
- 10/100Mbit Auto-negotiating RJ45 Copper Ports
- Copper and Fiber Optic Gigabit Ports



ML3000
Managed Ethernet Switch with
Future 1588v2 Support



ML2400
19" Rack-mounted Managed Switch



ML1600
9" Panel-mounted Managed Switch



ML600
Unmanaged Compact Switch



ML3000

Managed Ethernet Switch with Future 1588v2 Support

Key Benefits

- High density substation Ethernet switch
- Up to 36 ports copper
- Up to 18 ports fiber
- Power over Ethernet capable, supports up to 32 ports PoE reducing wiring complexity and cost
- 1588v2 ready for high precision timing applications, such as synchrophasor and IEC 61850 Process Bus

Applications

- Enables high speed, redundant connections to GE's Multilin™ Universal Relays
- Merging units, synchrophasor, and high precision timing applications
- Power over Ethernet allows easy cabling for VoIP telephones, badge readers and surveillance cameras

Features

Managed Networks

- Future 1588v2 timing support
- Supports SNMPv3 with full backwards compatibility for v1 and v2
- Traffic segregation and prioritization control via IEEE 802.1p and IEEE 802.1Q
- Hardware and software alarm contacts for detection of critical network or switch events
- LLDP to support topology discovery in Network Management Systems (NMS)

Ease-of-Use

- Support for industrial protocols (e.g. Modbus)
- IP out-of-the-box for easy installation and initial setup
- Simple but powerful web management interface for all configuration functions

Industrially Hardened

- UL listed/CE agency approved
- IEC 61850 and IEEE 1613 approval for operation in electric substation environments
- Redundant and mixed power supply options for increased reliability
- Harsh chemical environment options ensure product function and viability

Secure

- Secure management via SSL
- Port security prevents unauthorized devices from gaining access to the network
- Multi-level passwords with levels of privilege and command for different users or groups
- Complete event logging for forensic and regulatory auditing and reporting



Relays and Meters Communications

ML3000

Managed Ethernet Switch with Future 1588v2 Support
Ordering

Section 22

		GigE		10 or 100Mbps											
		1	2	3	4	5	6	7	8	9	10				
ML3000		*	**	*	*	*	*	*	*	*	*	*	*	ML3000 Chassis with Fixed Power Supplies	
Mounting	F													Front Mounted Ports	
	B													Rear Mounted Ports	
Power Supply	HX													Single Integrated 90 to 250V AC/DC Power Supply	
	HH													Dual Integrated 90 to 250V AC/DC Power Supplies	
	LX													Single Integrated 22 to 60 VDC Power Supply	
	LL													Dual Integrated 22 to 60 VDC Power Supplies	
	P1													Single Integrated 22 to 60 VDC Power Supply with PoE Support	
	P2													Dual Integrated 22 to 60 VDC Power Supply with PoE Support	
	HL													Combination of a 90 to 250V AC/DC and a 22 to 60 VDC Power Supply	
Gigabit	A	A												2x 1000 Mbits RJ-45 Fixed Ports	
	B	B												2x 1000 Mbit SFP, LC Connector, multimode Fiber, 550m	
	C	C												2x 1000 Mbit SFP, LC Connector, singlemode Fiber, 2km	
	D	D												2x 1000 Mbit SFP, LC Connector, singlemode Fiber, 10km	
	E	E												2x 1000 Mbit SFP, LC Connector, singlemode Fiber, 25km	
	F	F												2x 1000 Mbit SFP, LC Connector, singlemode Fiber, 40km	
	G	G												2x 1000 Mbit SFP, LC Connector, singlemode Fiber, 70km	
	H	H												2x 1000 Mbit SFP ports (no transceivers) empty cage	
	X	X												None	
			A	A	A	A	A	A	A	A	A			4x 10/100 Mbit - RJ45 Copper	
100Mbps			B	B	B	B	B	B	B	B	B			4x 10/100 Mbit - RJ45 Copper with PoE*	
			C	C	C	C	C	C	C	C	C			4x 10/100 Mbit - RJ45 Copper with PoE+*	
			D	D	D	D	D	D	D	D	D			2x 10Mbit - ST	
			E	E	E	E	E	E	E	E	E			2x 100Mbit - ST mm Fiber	
			F	F	F	F	F	F	F	F	F			2x 100Mbit - SC mm Fiber	
			G	G	G	G	G	G	G	G	G			4x 100Mbit - LC mm Fiber	
			H	H	H	H	H	H	H	H	H			4x 100Mbit - MTRJ mm Fiber	
			J	J	J	J	J	J	J	J	J			2x 100Mbit - SC sm Fiber 20km	
			K	K	K	K	K	K	K	K	K			4x 100Mbit - LC sm Fiber 20km	
			L	L	L	L	L	L	L	L	L			2x 100Mbit - SC sm Fiber 40km	
			M	M	M	M	M	M	M	M	M			4x 100Mbit - LC sm Fiber 40km	
			N	N	N	N	N	N	N	N	N			4x 100Mbit SFP ports (no transceivers) empty cage	
			X	X	X	X	X	X	X	X	X			None	
Coating												X		None	
												H		Harsh Chemical Environment Conformal Coating	

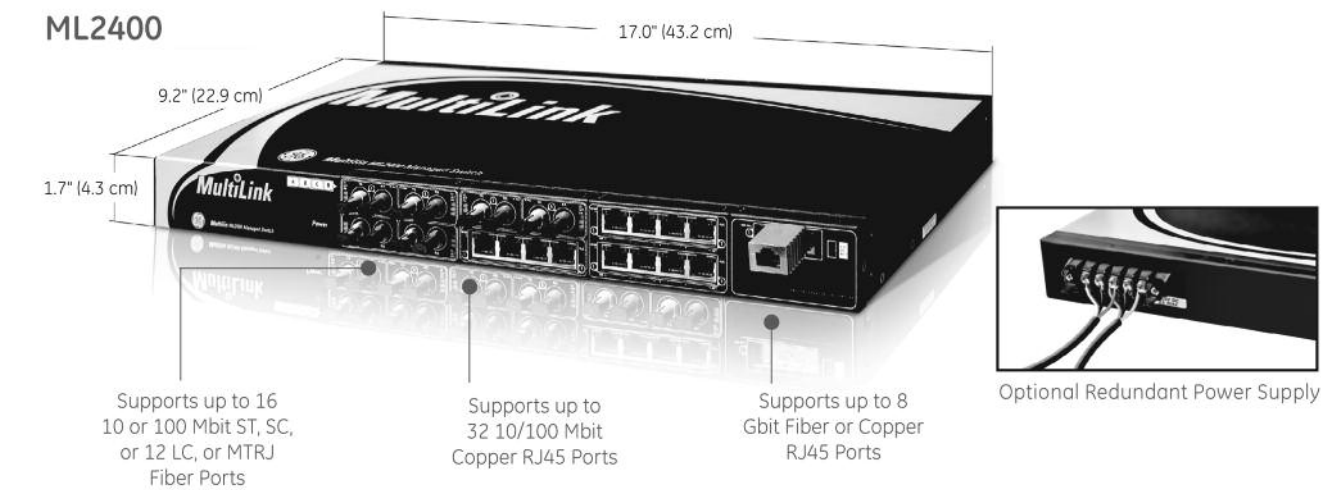
Notes:

- Slots 1 and 2 are for Gigabit Ports
- Slots 3 through 10 are for 100Mbps or 10Mbps ports
- Maximum fiber count is 18 ports when fiber is placed in slots 1,3,5,7 and 9
- Otherwise maximum fiber count is 16 ports
- If 1588 timing is selected in a slot, both top and bottom slots must support 1588. For example if Slot 3 is 1588v2 capable, then Slot 4 must also be 1588v2 capable or blank
- PoE power supply options must be selected in order to support PoE or PoE+ modules

DC Power Supply Range for PoE Applications:

- PoE 802.3af: 48 VDC Power Input (range 45 to 57 VDC)
- PoE+ 802.3at: 48 VDC Power Input (range 52 to 56 VDC)





ML2400 Managed Ethernet Switch

The MultiLink ML2400 is a 19" Rack Mountable hardened Managed Ethernet Switch that is designed specifically for use in Industrial Facilities, Substations and Transportation environments. It will supply you with reliable, high-speed networking of all your mission critical applications and provide flexibility and security with easy to use management functions that are unsurpassed in the industry.

Ordering

ML2400	-	*	-	**	-	**	-	**	**	**	**	-	*	Base Unit
Module														Front Mounted Ports
Port Mounting		F												Rear Mounted Ports
Power Supply		B		AC										100-240 VAC Power Supply
				HI										110-250 VDC/100-240 VAC Power Supply
				LO										48 VDC Power Supply
Redundant Power Supply						XX								No Redundant Power Supply
						HI								110-250 VDC/100-240 VAC Power Supply
						LO								48 VDC Power Supply
Modules								A1	A1	A1	A1			4 x 10 Mbit - ST mm Fiber
								A2	A2	A2	A2			4 x 100 Mbit - ST mm Fiber
								A3	A3	A3	A3			4 x 100 Mbit - SC mm Fiber
								A4	A4	A4	A4			8 x 10/100 Mbit - RJ45 Copper
								A5	A5	A5	A5			2 x 10 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								A6	A6	A6	A6			2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								A7	A7	A7	A7			2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								A8	A8	A8	A8			2 x 100 Mbit - SC sm Fiber 20km + 4 x 10/100 Mbit RJ45 Copper
								AA	AA	AA	AA			4 x 100 Mbit - LC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								AB	AB	AB	AB			8 x 100 Mbit - LC mm Fiber
								AC	AC	AC	AC			4 x 100 Mbit - LC sm Fiber + 4 x 10/100 Mbit RJ45 Copper
								AD	AD	AD	AD			8 x 100 Mbit - LC sm Fiber
								AE	AE	AE	AE			2 x 100 Mbit - LC sm Fiber + 6 x 10/100 Mbit RJ45 Copper
								AF	AF	AF	AF			2 x 10 Mbit - ST mm Fiber + 2 x 100 Mbit - ST mm Fiber
								AH	AH	AH	AH			8 x 100 Mbit - MTRJ mm Fiber
								AJ	AJ	AJ	AJ			4 x 100 Mbit - MTRJ mm Fiber + 4 x 10/100 Mbit RJ45 Copper
								AK	AK	AK	AK			2 x 100 Mbit - MTRJ mm Fiber + 6 x 10/100 Mbit RJ45 Copper
								G3	G3	G3	G3			1 x 1000 Mbit - SC mm Fiber 2km + 2 x 100 Mbit - SC mm Fiber
								G4	G4	G4	G4			1 x 1000 Mbit - SC mm Fiber 2km + 4 x 10/100 Mbit - RJ45 Copper
								G5	G5	G5	G5			2 x 1000 Mbit - SC mm Fiber 2km
								G6	G6	G6	G6			1 x 1000 Mbit - RJ45 Copper
								G7	G7	G7	G7			1 x 1000 Mbit - SC mm Fiber 2km
								G8	G8	G8	G8			1 x 1000 Mbit - SC sm Fiber 10 km
								GC	GC	GC	GC			1 x 1000 Mbit - RJ45 Copper + 2 x 100 Mbit - SC mm Fiber
								GD	GD	GD	GD			1 x 1000 Mbit - RJ45 Copper + 4 x 10/100 Mbit - RJ45 Copper
								GE	GE	GE	GE			2 x 1000 Mbit - RJ45 Copper
								GF	GF	GF	GF			1 x 1000 Mbit - SC sm Fiber 10km + 2 x 100 Mbit - SC mm Fiber
								GH	GH	GH	GH			1 x 1000 Mbit - SC sm Fiber 10km + 4 x 10/100 Mbit - RJ45 Copper
								GJ	GJ	GJ	GJ			2 x 1000 Mbit - SC sm Fiber 10km
Harsh Environment												X		Standard Environment
												H		Harsh Chemical Environment Option

Accessories for the ML2400

Industrial Power System	
Communications Learning CD	TRCD-ICOM-C-S-1
MultiNet™	Multinet-FE
EnerVista™ Integrator	EVI-1000

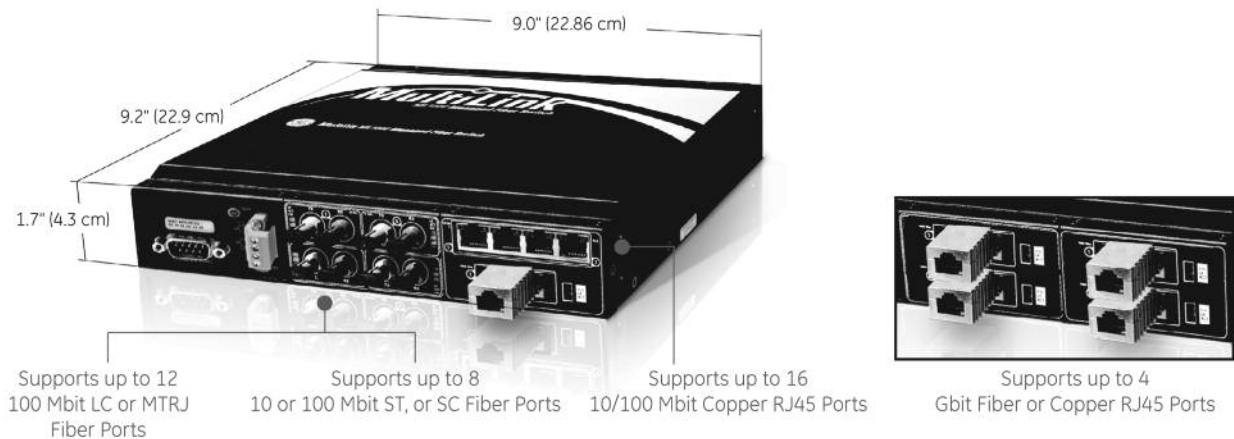
* Additional modules and configurations available. Please see the Online Store for the latest module availability.

Visit www.GEMultilin.com/ML2400 to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a ML2400 online
- View the Multilink Family brochure



ML1600



ML1600 Managed Ethernet Switch

The MultiLink ML1600 is a 9" Panel Mounted hardened Managed Ethernet Switch that is designed specifically for use in Industrial Facilities, Substations, and Transportation environments. It will supply you with reliable, high speed networking of all your mission critical applications and provide flexibility and security with easy to use management functions that are unsurpassed in the industry.

Ordering

ML1600	-	**	-	**	**	-	*	Base Unit
Module				A	B			
Power Supply	AC	HI	LO					100-240 VAC Power Supply 110-250 VDC/100-240 VAC Power Supply 48 VDC Power Supply
Modules				A1	A1			4 x 10 Mbit - ST mm Fiber
				A2	A2			4 x 100 Mbit - ST mm Fiber
				A3	A3			4 x 100 Mbit - SC mm Fiber
				A4	A4			8 x 10/100 Mbit - RJ45 Copper
				A5	A5			2 x 10 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A6	A6			2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A7	A7			2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				A8	A8			2 x 100 Mbit - SC sm Fiber 20km + 4 x 10/100 Mbit RJ45 Copper
				AA	AA			4 x 100 Mbit - LC mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AB	AB			8 x 100 Mbit - LC mm Fiber
				AC	AC			4 x 100 Mbit - LC sm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AD	AD			8 x 100 Mbit - LC sm Fiber
				AE	AE			2 x 100 Mbit - LC sm Fiber + 6 x 10/100 Mbit RJ45 Copper
				AF	AF			2 x 10 Mbit - ST mm Fiber + 2 x 100 Mbit - ST mm Fiber
				AH	AH			8 x 100 Mbit - MTRJ mm Fiber
				AJ	AJ			4 x 100 Mbit - MTRJ mm Fiber + 4 x 10/100 Mbit RJ45 Copper
				AK	AK			2 x 100 Mbit - MTRJ mm Fiber + 6 x 10/100 Mbit RJ45 Copper
				G3	G3			1 x 1000 Mbit - SC mm Fiber 2km + 2 x 100 Mbit - SC mm Fiber
				G4	G4			1 x 1000 Mbit - SC mm Fiber 2km + 4 x 10/100 Mbit - RJ45 Copper
				G5	G5			2 x 1000 Mbit - SC mm Fiber 2km
				G6	G6			1 x 1000 Mbit - RJ45 Copper
				G7	G7			1 x 1000 Mbit - SC mm Fiber 2km
				G8	G8			1 x 1000 Mbit - SC sm Fiber 10 km
				GC	GC			1 x 1000 Mbit - RJ45 Copper + 2 x 100 Mbit - SC mm Fiber
				GD	GD			1 x 1000 Mbit - RJ45 Copper + 4 x 10/100 Mbit - RJ45 Copper
				GE	GE			2 x 1000 Mbit - RJ45 Copper
				GF	GF			1 x 1000 Mbit - SC sm Fiber 10km + 2 x 100 Mbit - SC mm Fiber
				GH	GH			1 x 1000 Mbit - SC sm Fiber 10km + 4 x 10/100 Mbit - RJ45 Copper
				GJ	GJ			2 x 1000 Mbit - SC sm Fiber 10km
Harsh Environment						X		Standard Environment
						H		Harsh Chemical Environment Option

Accessories for the ML1600

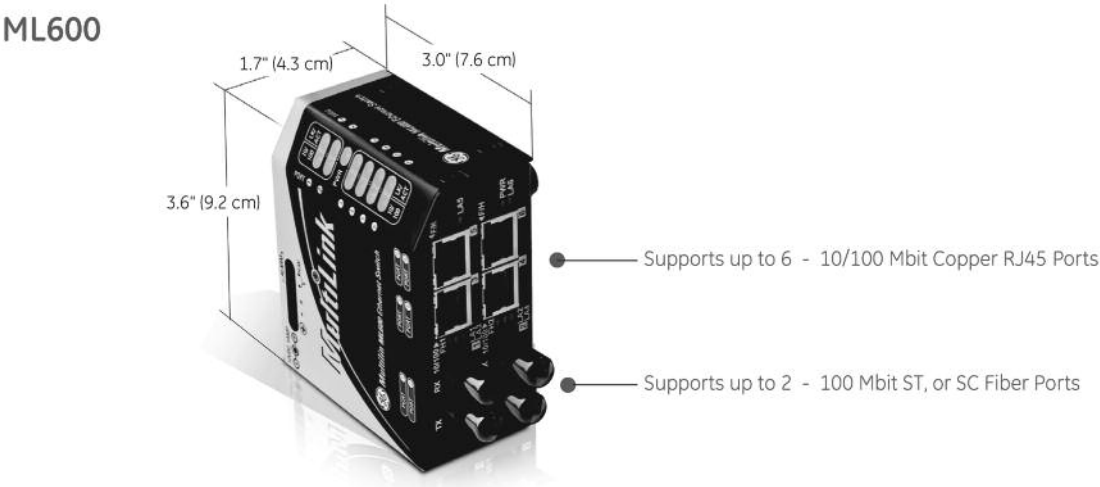
Industrial Power System	
Communications Learning CD	TRCD-ICOM-C-S-1
MultiNet™	Multinet-FE
EnerVista™ Integrator	EVI-1000

* Additional modules and configurations available. Please see the Online Store for the latest module availability.

Visit www.GEMultilin.com/ML1600 to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a ML1600 online
- View the Multilink Family brochure





ML600 Compact Ethernet Switch

The MultiLink ML600 is a Compact Unmanaged Ethernet Switch that is ideal for Industrial Facilities, Substations, and Transportation environments that have few Ethernet devices in one location. As a very cost effective solution, the ML600 will supply you with high speed networking in your harsh environments and is equipped with Link Loss Learn (LLL) that allows for use in redundant architectures thus ensuring you will always have access to your devices.

Ordering

ML600	-	**	-	**	-	Base Unit
Power Supply		AC				External 100 - 240 VAC Adaptor
		HI				30 - 60 VDC Power Supply
		LO				10 - 36 VDC Power Supply
Modules				XX		None
				B1		6 x 10/100 Mbit - RJ45 Copper
				B2		2 x 100 Mbit - ST mm Fiber + 4 x 10/100 Mbit - RJ45 Copper
				B3		2 x 100 Mbit - SC mm Fiber + 4 x 10/100 Mbit - RJ45 Copper
				B4		2 x 100 Mbit - SC sm Fiber + 4 x 10/100 Mbit - RJ45 Copper

Accessories for the ML600

Industrial Power System	
Communications Learning CD	TRCD-ICOM-C-S-1
MultiNet™	Multinet-FE
EnerVista™ Integrator	EVI-1000

* Additional modules and configurations available. Please see the Online Store for the latest module availability.

Visit www.GEMultilin.com/ML600 to:

- View Guideform specifications
- Download the instruction manual
- Review applications Notes and support documents
- Buy a ML600 online
- View the Multilink Family brochure



[MultiNet™](#)

[page 22-188](#)

MultiNet™ is a communications module that provides GE Multilin™ serial ModBus IEDs with ModBus TCP/IP communications over Ethernet, allowing connection to fiber optic LAN and WAN network systems.



[F485](#)

[page 22-189](#)

The F485 is a self-contained device for converting between RS232, RS485 and fiber optic signals. The F485 is electrically isolated to improve communications in noisy environments.



[D485](#)

[page 22-189](#)

The D485 Modbus to DeviceNet Converter acts as a gateway between a Modbus RTU network and a DeviceNet network. Integration of Modbus devices into DeviceNet networks is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.



[P485](#)

[page 22-189](#)

The P485 Modbus to Profibus Converter acts as a gateway between a Modbus RTU network and a Profibus-DP network. Integration of Modbus devices into Profibus networks is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.



[USB to Serial](#)

[page 22-189](#)

This cable is the solution for users who want to communicate with GE Multilin™ IEDs via PCs that have USB communication ports. Using this cable is quick and easy. Simply install the cable driver on your PC, plug in the cable and you are ready to communicate.



Multinet™ Serial to Ethernet Converter

Ethernet communications made simple for any GE Multilin™ IED

Key Benefits

- Converts Modbus RTU over RS485 into Modbus TCP/IP over Ethernet
- Supports both 10BaseT and 10BaseF fiber connections
- Connect up to 32 RS485 serial devices to an Ethernet network
- Modbus TCP/IP provides multiple SCADA masters allowing simultaneous communications to the same IED
- Flexible mounting options allow retrofit to existing devices.
- Industrial hardened for utility and industrial applications
- Simple “plug & play” device setup with EnerVista™ software

Applications

Provides Modbus TCP/IP communications to the following Multilin devices:

- PQM / PQM II - Power Quality Meter
- SR Family IEDs
- M Family IEDs
- ALPS - Advanced Line Protection System
- DDS Family IEDs
- Other Modbus RTU compatible devices
- Includes EnerVista™ software - an industry-leading suite of software tools that simplifies every aspect of working with GE Multilin™ devices

Mounting



Rail Mounted



Features

User Interfaces

- 10BaseT: RJ45 connection
- 10BaseF: 820 nm, multi-mode, fiber optic with ST connector
- RS485 2-wire, half duplex, isolated



Example of Multinet rail mounted in Switch Gear

Ordering

Multinet™	*	Description
Multinet™	*	Modbus RTU to Modbus TCP/IP converter with RS485 Comm.RS232 comm port
	FE	10BaseT ethernet port and 10BaseF fiber port

Visit www.GEMultilin.com/Multinet to:

- Watch MultiNet™ installation video
- Download the instruction manual
- Review applications notes and support documents
- Buy a MultiNet™ online
- View the MultiNet™ brochure



F485



Isolated RS232 to RS485 to Fiber Optic Converter

- Versatile, simple design in a self-contained unit
- Simplifies communications between IEDs, computers and other equipment
- Direct or modem communications
- Electrically isolated for reliable communications in noisy environments
- Up to 57,600 bps communication rate
- Operates with multimode fiber optic cables
- 120 or 220 VAC adapter included
- Additional power supply terminals accept external 9 VAC/VDC source
- Two mounting configurations
- Internal switches for selecting signal conversion type

Visit www.GEMultilin.com/F485 to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a F485 online

D485



Modbus to DeviceNet Converter

- Integrate GE protective relays, meters or other Modbus-compliant devices into DeviceNet networks
- Easy-to-use, PC-based EnerVista™ Setup Software for simple configuration
- Connects up to 10 Modbus devices to a DeviceNet network
- Supports DeviceNet "Adapter" functionality (Profile Number 12)
- Supports DeviceNet baud rates 125 Kbps, 250 Kbps and 500 Kbps
- Supports up to 50 Modbus Transactions
- Connects to DeviceNet network using 5-pin linear DeviceNet plug
- Supports Modbus baud rate of 1200bps to 57600bps
- Modbus interfaces supported: RS232, RS422, RS485
- DIN-rail mountable
- 24 VDC input power

Visit www.GEMultilin.com/D485 to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a D485 online

P485



Modbus to Profibus Converter

- Integrate GE protective relays, meters or other Modbus-compliant devices into Profibus networks
- Easy-to-use, PC-based EnerVista™ Setup Software for simple configuration
- Connects up to 10 Modbus devices to a Profibus network
- Complete Profibus-DP slave functionality as per IEC61158
- Supports Profibus baud rate of 9.6Kbps to 12 Mbps
- Profibus interface supported: RS485
- Supports Modbus baud rate of 1200bps to 57600bps
- Modbus interfaces supported: RS232, RS422, RS485
- Supports up to 50 Modbus Transactions
- DIN-rail mountable
- 24 VDC input power
- CE, UL and cUL certified

Visit www.GEMultilin.com/P485 to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a P485 online

USB to Serial



USB to Serial Cable Converter

- Designed for high speed transmissions for optimal performance
- Premium quality, flexible 6 ft long cable
- Ergonomic molding for easy connections
- RS-232C standard compliant
- Powered by your computer's USB bus
- DB 9 male connector

Visit www.GEMultilin.com/usb2serial to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a USB to Serial online



Relays and Meters

Power Sensing

Instrument Transformers

Section 22

Low Voltage Current Transformers – 600 Volt Class Indoor Type

Split Core Current Transformers



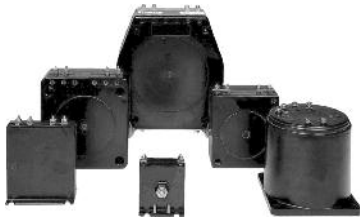
Applications

- Energy management
- Load surveys
- Sub metering

Features

- Window sizes from 0.75 x 0.75 to 12 x 30 inches
- Ratios from 100:5A to 10,000:5A
- Voltage output available
- Weather proof model available
- UL Recognized and CSA Approved

Auxiliary Current Transformers



Applications

- Designed for use in the secondary of main current transformers to change the ratio for metering or relaying applications

Features

- Several models available
- Wound primary up to 50A
- IEEE or IEC metering and relay class
- Summation CT's up to six secondaries
- UL Recognized and CSA Approved

Three Phase Current Transformers



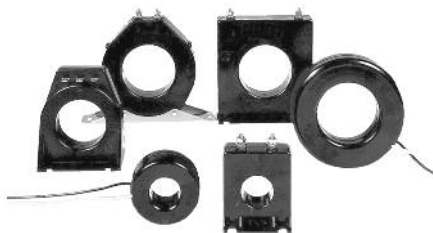
Applications

- Three phase metering and motor over-load protection

Features

- Over 50 models available
- Saves space and reduces installation time
- Zero sequence core in the same package available for most models
- Ratios from 50:5A to 4000:5A
- UL Recognized and CSA Approved

Current Transformers



Applications

- For use with ammeters in panelboards, control panels and engine generators

Features

- Wide range of window sizes
- Ratios 50:5A to 2000:5A
- 1 Amp secondaries are available
- Supplied with leads or terminals
- Integral feet or mounting brackets available
- UL Listed and CSA Approved



Relays and Meters

Power Sensing

Instrument Transformers

Section 22

Low Voltage Current Transformers – 600 Volt Class Indoor Type

Current Transformers



Applications

- For metering and relaying applications in low voltage switchboards, switchgear and motor control

Features

- Wide range of window sizes
- Ratios 50:5A to 6000:5A
- 1 Amp secondaries are available
- Supplied with leads or terminals
- Multi ratios model available
- Designed to meet IEEE C57. 13 or IEC 60044-1
- UL listed and CSA Approved

Current Transformers



Applications

- Designed for specific mount applications in low and medium voltage switchgear

Features

- Wide range of window sizes
- Ratios 50:5A to 6000:5A
- 1 Amp secondaries are available
- Multi ratios model available
- Designed to meet IEEE C57. 13
- UL listed and CSA Approved

Current Transformers



Applications

- For ammeters, wattmeters, and cross current compensation applications

Features

- Wide range of window sizes
- Ratios 50:5A to 6000:5A
- 1 Amp secondaries are available
- Supplied with leads or terminals
- Integral feet or mounting brackets available
- UL Listed and CSA Approved

Ground Fault Sensors



Applications

- To sense zero sequence ground fault currents

Features

- Window sizes up to 30x 10 inches are available
- Ratios 50:5A and up
- Special ratios and physical sizes built to customer specifications
- UL Recognized and CSA Approved



Relays and Meters

Power Sensing

Instrument Transformers

Low Voltage Current Transformers – 600 Volt Class Indoor Type

Section 22

Ground Fault Sensors Type HGF



Applications

- Designed to match the ground fault input of GE Multilin™ motor protection relays

Features

- Window sizes 3.75" , 5.75" or 8.13"
- Ratio 50:0.025A 60 Hz
- IEC versions also available
- UL and CUL recognized

Current Transformers



Applications

- Designed for operation of meters and instruments
- Utility metering
- Mounts directly on busbars or padmount transformer spade

Features

- Window sizes 3.46" x 4.16"
- Ratios 200:5 to 4000:5
- Meet ANSI C12 size and mounting

Current Transformers



Applications

- Designed for operation of meters and instruments
- Utility metering small window

Features

- Designed for outdoor service
- Encapsulated in cast polyurethane resin
- Compression type terminals
- Ratios from 100:5A to 800:5A
- Dual ratio models available
- Engraved aluminum name plate
- Meet ANSI C12 size and mounting

Current Transformers



Applications

- Designed for operation of meters and instruments
- Utility metering large window

Features

- Designed for outdoor service
- Compression type terminals
- Ratios from 200:5A to 4000:5A
- Dual ratio models available
- Engraved aluminum name plate
- Meet ANSI C12 size and mounting



Relays and Meters

Power Sensing

Instrument Transformers

Low Voltage Potential Transformers – 600 Volt Class Indoor Type

Section 22

Voltage Transformers



Applications

- For single phase voltage measurement in AC power systems

Features

- Resin cast moulded plastic cases
- Integral fuses available on some models
- Designed to meet IEEE C57.13
- 50Hz design available
- UL Recognized and CSA Approved

Voltage Transformers



Applications

- For three phase voltage measurement in AC power systems

Features

- Resin cast moulded plastic cases
- Integral fuses available on some models
- Designed to meet IEEE C57.13
- 50Hz design available
- UL Recognized and CSA Approved

JVA Voltage Transformers



Applications

- Designed for indoor and outdoor service; suitable for operation meters, instrument transformers, relays, and control devices.
- Utility metering

Features

- Housed in a resin filled plastic case
- Compression type terminals
- 50Hz design available
- Transparent plastic terminals cover
- Engraved aluminum nameplate
- Designed to meet IEEE C57.13



Relays and Meters

Power Sensing

Instrument Transformers

Section 22

Bushing Current Transformers – 600 Volt Class

Cast Resin Unit



Applications

- For use over bushings of power transformers and dead tank circuit breakers
- For metering and relaying applications

Features

- Indoor or outdoor service
- 600V class to IEEE C57.13 or IEC 60044-1
- Ratios 50:5 to 25000:5
- Single and multi ratios available
- Optional ground shield available

Taped Unit



Applications

- Designed to customers specifications for metering and relaying applications
- High voltage circuit breakers and power transformers

Features

- 600V class to IEEE C57.13 - 1993
- Single and multi ratio designs available
- Leads or terminals available
- Designs for use in oil are available

Board Mounted Unit



Applications

- Designed for mounting and stacking over the bushings of large generators
- For metering and relaying applications

Features

- Ratios up to 40,000:5A
- 1 Amp secondaries and IEC design available
- 600V class 50 or 60Hz
- Shield winding available

Medium Voltage Current and Potential Transformers – 5kV o 38kV Indoor Type

Voltage Transformers



Applications

- Indoor voltage transformers for metering and relaying applications in AC power systems

Features

- Vacuum cast polyurethane resin
- Designed to meet IEEE C57.13
- 5kV to 34.5kV with BIL rating up to 200kV
- UL Recognized and CSA Approved

Current Transformers



Applications

- Indoor current transformers for metering and relaying applications in AC power systems

Features

- Vacuum cast polyurethane resin
- Designed to meet IEEE C57.13
- 5kV to 34.5kV with BIL rating up to 200kV
- UL Recognized and CSA Approved



Relays and Meters

Power Sensing

Instrument Transformers

Section 22

Control Power Transformers – 5kV to 38kV Indoor Type

Single Phase Cast Coil Transformers



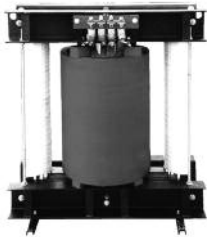
Applications

- To provide control power in medium voltage switchgear

Features

- Vacuum cast primary coil using epoxy resin
- Single phase rating from 5 kVA to 37.5 kVA
- Voltage rating 5 to 15 kV and BIL rating to 95 kV BIL

Single Phase Cast Coil Transformers



Applications

- To provide control power in medium voltage switchgear
- Generator neutral grounding transformer

Features

- Vacuum cast primary and secondary coils using epoxy resin
- Single phase rating from 25 kVA to 75 kVA
- Voltage rating 5 to 34.5kV and BIL rating to 150 kV BIL

Three Phase Cast Coil Transformers



Application

- To provide control power in medium voltage switchgear

Features

- Vacuum cast using epoxy resin
- Three phase rating from 15 kVA to 150 kVA
- Voltage rating 5 to 34.5kV and BIL rating to 150 kV BIL
- Horizontal and vertical mounting available in some models

Current Transducers – 600 Volt Class

Current Transducers



Applications

- Process control
- Industrial measurement

Features

- Models available for 5 to 600 primary AC current
- Output 4-20 mA dc
- UL recognized



Relays and Meters

Power Sensing

Instrument Transformers

Section 22

IEC-Rated Instrument Transformers

Current Transformers (Low Voltage)



Applications

- Suitable for measuring applications in AC power systems

Features

- Available for indoor applications
- DIN rail mounting
- Designed to meet IEC 60044-1
- 720V rated

Current Transformers (Medium Voltage)



Applications

- Suitable for measuring and protection applications in AC power systems

Features

- Available for indoor or outdoor applications
- Vacuum cast in epoxy resin
- Designed to meet IEC 60044-1
- Available from 12 to 36 kV
- Multiple core designs available for measuring and protection in one package

Voltage Transformers (Medium Voltage)



Applications

- Suitable for measuring and protection applications in AC power systems

Features

- Available for indoor or outdoor applications
- Vacuum cast in epoxy resin
- Designed to meet IEC 60044-2
- Available from 12 to 36 kV
- Rated Voltage Factor: 1.2/1.9 (Continuous/8 hours)

Visit www.GEMultilin.com/ITI to:

- View catalog sheets
- Review applications Notes and support documents
- Buy an instrument transformer online
- View the product brochures



SB-1 Control and Transfer Switches



Rotary switch for circuit breaker control, motor control or instrument transfer.

Applications

- Control of electrically operated circuit breakers, valves, motors, etc.

Features

- Transfer current and potential to instruments and relays
- Standard mounts on panels up to 3/16" (up to 2" available)
- Up to 16 stages (32 contacts)
- Tandem mechanisms available
- Yale lock or locking handle available
- Silver to silver positive wiping action contacts

- Rated 600 V, 20 A continuous (250 A for three seconds)
- Palladium contacts for low level instrument circuits available
- Pull-to-lock and pull-to-turn actions available
- Up to 12 positions, 360° rotation
- Four types of escutcheons (switch face plates)
- Eight types of fixed handles (black only)
- Three types of removable handles
- Maintained or spring return switch action
- NEMA 1 cover
- UL recognized

SB-9 Master Control Switches



Rotary switch for frequent control of circuit breaker, motor, or magnetic switch.

Applications

- Steel mills, petroleum/chemical plants, power plants, heavy industries
- Repetitive positive positioning operation (thousands/week)

Features

- Standard mounts on panels up to 3/16" (up to 2" available)
- Up to 16 stages (32 contacts)
- Tandem mechanisms available
- Yale lock or locking handle available
- Silver to silver positive wiping action contacts
- Rated 600 V, 20 A continuous (250 A for three seconds)

- Palladium contacts for low level instrument circuits available
- Pull-to-lock and pull-to-turn actions available
- More positive positioning than SB-1
- Better insulation to ground than SB-1
- More substantial bearings than SB-1
- Up to 12 positions, 360° rotation
- Four types of escutcheons (switch face plates)
- Eight types of fixed handles
- Three types of removable handles
- Maintained or spring return switch action
- NEMA 1 cover
- UL recognized

Series 95 Heavy Duty Rotary Switches



Applications

- Circuit breaker control switches
- Ammeter/voltmeter selector switches
- Lock-out relays (LOR)

Features

- Self cleaning silver plated contacts
- Standard 3 - hole mounting
- Pull -to - lock mechanism available
- Continuous 600v 30A rating
- UL Recognized and CUL



SB-10 Control and Transfer Switches



Rotary / lateral switches for circuit breaker control, motor control or instrument transfer.

Applications

- Control of electrically-operated circuit breakers, valves, motors, etc.
- Transfer current and potential to instruments and relays

Features

- Lateral action eliminates second separate switch
- Two electrically separate and mechanically independent switches in one device
- Standard mounts on panels up to 3/16" (up to 2" available)
- Up to 12 stages (24 contacts) of rotary contacts (includes lateral and rotary)
- Up to four stages (eight contacts) of lateral contacts (in-out action)
- Lateral action interlock with rotary position available
- Tandem mechanisms available
- Yale lock above handle available
- Silver to silver positive wiping action contacts
- Rated 600 V, 20 A continuous (250 A for three seconds)
- Palladium contacts for low level instrument circuits available
- Up to 12 rotary positions, 360° rotation
- Three escutcheons types (switch face plates)
- Seven types of fixed handles
- Maintained or spring return switch action
- NEMA 1 cover
- UL recognized

SBM Control and Transfer Switches



Rotary switch for circuit breaker control, motor control or instrument transfer.

Applications

- Control of electric-operated circuit breakers, valves, motors, etc.
- Transfer current and potential to instruments and relays

Features

- Limited space applications
- Compact design
- Up to 10 stages (20 contacts)
- Double surface cams (one cam per contact)
- Add-a-stage feature for adding up to two stages
- Electrically separate and mechanically independent doublebreak contacts
- Standard mounts on panels up to 1/4" (up to 1.5" available)
- Rated 600 V, 20 A continuous
- Silver to silver positive wiping action contacts
- Pull-to-lock action available
- Up to eight positions, 360° rotation
- Three types of escutcheons (switch face plates)
- Eight types of fixed handles
- Three types of removable handles
- Handles to match SB-1 available
- Maintained or spring return switch action
- UL recognized

FT and RT Test Switch



Applications

- Multi - circuit testing of switchboard relays, meters and Instruments

Features

- Semi - flush panel mounting
- Mounting base and cover
- Up To 10 Individual knife blade switches
- Clear cover and colored handles available
- UL Recognized and CUL
- Available as a rack mounted assembly

Indicator Lights

ET-16 Incandescent Indicating Lights



—Various voltages and color caps available

ET-16 LED Light Emitting Diodes



—Various voltages, LED colors and color caps available

ET-17 Neon Indicating Light



—Various voltages and color caps available

Test Equipment

515 Blocking and Test Module



—Provides an effective means of trip blocking, relay isolation, and testing of protective relays

PK-2 Test Block and Plugs



—Facilitates the testing of AC instruments, meters and relays

XCA Test Probes and Plugs



—Test probes and plugs for C-case drawout relays

XLA Test Plugs



—Test plugs for drawout relays

Terminal Blocks

116B407 Pullout Fuse Blocks



—Class J pullout blocks, available in two or three-fuse modes

Terminal Blocks for Connecting Leads



—EB-25 - washerhead binding screws
—EB-26 - clamp type connectors
—EB-27 - short circuit strips
—IKU - Control wire termination, Rated for 600V, 50 Amp

EB-1 Terminal Block



—Used where a high current rated block is required
—Rated for 600 V – 100 A circuits

EB-2 Terminal Block



—Used where a high current rated block is required
—Rated for 600 V – 100 A circuits

EB-4 Terminal Block



—Provided with 2, 4 or 6 points
—Rated for 600 V – 30 A circuits



Relays and Meters

Test Equipment

RTT Desktop Test Set

Economical current, voltage, and digital input injection test set

Section 22

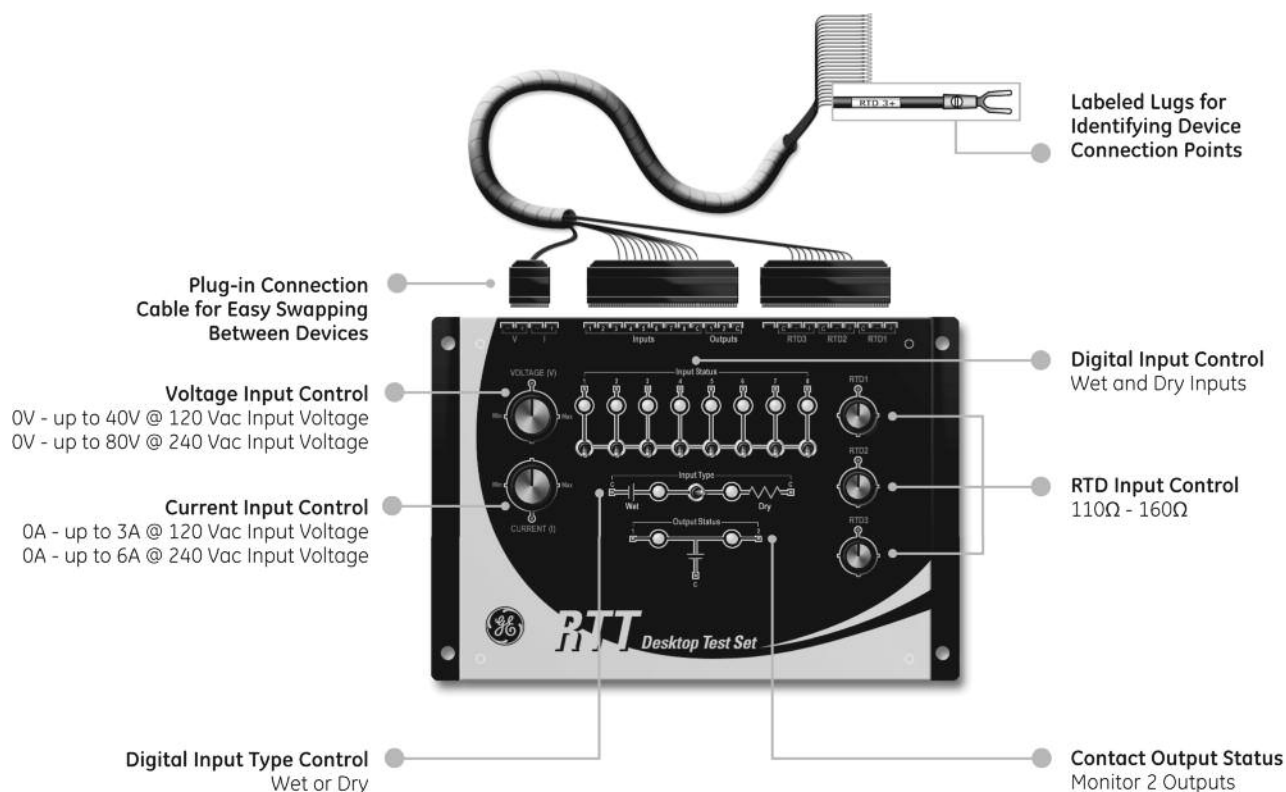
Key Benefits

- Economical method for testing the operation of protection relays, meters, and PLC's
- Cost effective tools for performing hands on relay, meter, or PLC training
- Real time control of relays and meter input including AC voltage, AC current, digital inputs, and RTDs
- Provides a method for testing protective relay and meter settings files before sending to the field for commissioning
- Effective tool for validating the operation of logic schemes designed in protective relays and programmable logic controllers

Features

- Single phase AC current injection
(0 to 3 Amps @ 120 Vac input voltage)
(0 to 6 Amps @ 240 Vac input voltage)
- Single phase AC voltage injection
(0 to 40 Volts @ 120 Vac input voltage)
(0 to 80 Volts @ 240 Vac input voltage)
- Force the status of 8 Digital Inputs (Wet and Dry)
- Monitor the status of 2 Contact Outputs
- Control of 3 RTDs (Resistance Temperature Detectors)
(110 to 160 Ohms)
- Removable Device Connection cables for easy switching between multiple relays and meters
- UL Listed and CE Certified
- Operate at both 120 Vac and 240 Vac input power
- Includes detailed wiring diagrams for connecting to most GE Multilin™ protective relaying and metering devices





Ordering

Base	Description
RTT	Desktop Test Set with one device connection cable

Accessories:

RTT-Cable	Additional device connection cable
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Visit www.GEMultilin.com/RTT to:

- Download the instruction manual
- Review applications notes and support documents
- Buy a RTT online

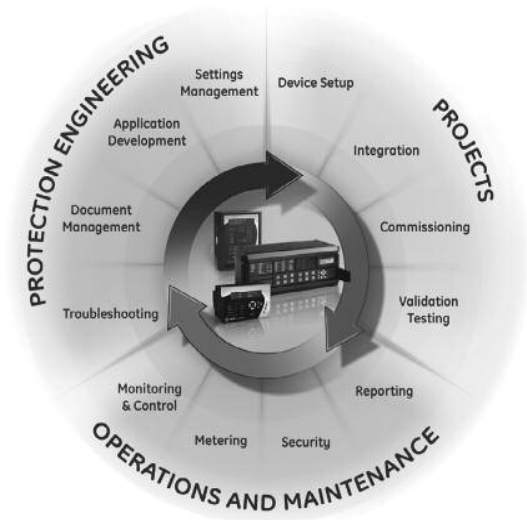


Relays and Meters Software

EnerVista™ Suite

Designed to simplify every aspect of your workflow processes

Section 22



Launchpad

page 22-203

Device Setup & Document Management Toolset

Launchpad is the powerful toolset management engine for all of the support resources needed for GE Multilin™ products, including setup software, manuals and firmware files. The Launchpad subscription mechanism ensures that all of your necessary files are kept up-to-date and most importantly you only receive updates on the information you are interested in. The EnerVista™ Setup tools provide a consistent look-and-feel for all GEMultilin devices, shortening the learning curve needed to be productive.

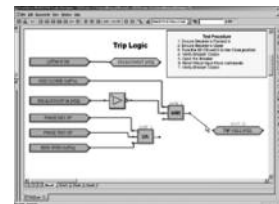


Viewpoint Engineer

page 22-206

Logic, IEC61850 System Configuration and Real-Time Monitoring

Viewpoint Engineer is the most advanced tool for protection & control engineers and commissioning staff available. Use the full-featured Graphical Logic Designer to build and annotate complex FlexLogic™ and then observe it in real-time with the Graphical Logic Monitor. Use the System Designer option to design and annotate IEC61850 communication schemes, including ICD file import and SCD file export for non-GE IEDs.

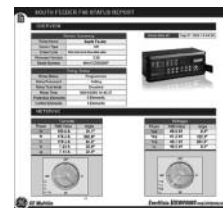


Viewpoint Maintenance

page 22-210

Security Auditing, Device and Asset Health Reporting and Fault Data Retrieval

Comprehensive Security Report outlines changes to device settings, including the MAC address if the change was made via Ethernet for compliance with NERC Critical Infrastructure Protection standards. Device and Asset Status Reports detail current and historical health for both the IED and the asset being protected.



Viewpoint Monitoring

page 22-214

Easy-to-Use Monitoring and Data Recording

Viewpoint Monitoring provides simplified monitoring of real-time data from all GE Multilin™ using ready-made Plug-and-Play screens. Built-in data logger, alarm annunciator and time synchronization round out this HMI package. Third-party devices can be incorporated using either generic Modbus RTU or Modbus TCP/IP or IEC61850 and optional OPC server connectivity can link to existing facility DCS or SCADA systems.



Integrator

page 22-224

Comprehensive Communication Engine for Rapid Integration

Seamless integration of GE Multilin™ devices into new or existing DCS, HMI or SCADA systems and other data consumer applications (data historians, data visualization tools) using standard open OPC connectivity.



Relays and Meters Software EnerVista™ Launchpad

Section 22

Device Setup, Document and Site Management Toolset

The EnerVista™ Launchpad software is a powerful toolset used for the complete support and management of Multilin products. Support applications including product software, manuals, and setting files management used to ensure your important files are kept up-to-date and easily accessible. Site Management allows you to properly maintain your asset and devices by providing real-time diagnostic data and reports.

Key Benefits

- Provides a simple and intuitive method for configuring all Multilin devices
- Ensures setup software, manuals and other support documentation is available to you and is always up to date
- Supplies all the tools necessary for analyzing faults to get your equipment back up and running
- Provides Asset and Device management capability at the click of a button

Key Features

- Configure and access all your Multilin devices from a single application
- Create and edit setting files offline or in real-time directly to your relays and meters
- Manage all of your support documents in a single reference library
- Provides an intuitive device health logic tool, which helps you to maximize your device capability.
- Receive automatic firmware, software, and hardware upgrade notices. Keep informed with the latest innovation and technology on your device when you register your Multilin products.
- Contains real-time metering, fault diagnostic and maintenance data for each connected device.

Site Management

- Organize your protection devices with one interface
- Automated power system monitoring directly from Launchpad
- A management toolset for all Multilin devices settings
- Receive comprehensive Site and Device reports from Launchpad

Software & Document Management

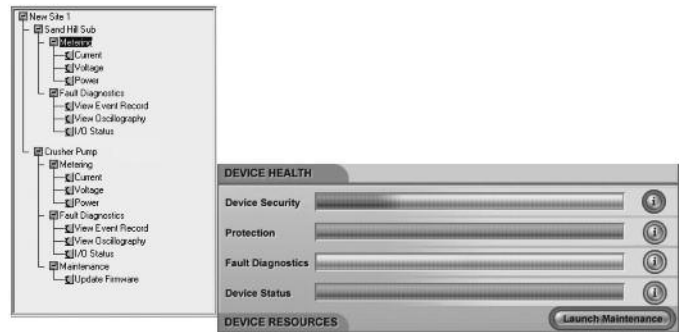
- Instantly identify, download, and install new versions of setup software when available with a single click
- Directly install new setup software and support documents without having to navigate to the website



Device Management & Health Logic

The device metering window provides system critical and diagnostics data such as Current, Voltages, and Event Records at your finger tips. The device health logic monitors defined setpoints and actual values, then returns results in a graphical, user friendly display. This tool will help you maintain the minimum required setting and assist you to maximize your relay capabilities. The 4 categories that are monitored are:

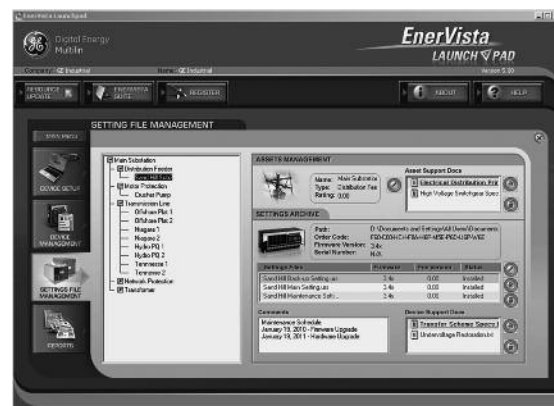
- Device Security – This tool will prevent unauthorized access to your relay setpoint file.
- Protection – This tool ensures your relay is configured with the minimum required protection settings.
- Fault Diagnostics – This feature monitors the main diagnostics tool in your relay and indicates when they are configured.
- Device Status – Ensures your protection relay is online and ready to protect your valuable assets.



Easily Configure and Manage your Multilin Setting Files

The setting file management tool comes standard with EnerVista Launchpad and provides a single platform to configure your Multilin protection device setting files. Additionally, you will have the ability to link related documents, such as specifications and equipment data sheets, to their respective protection device useful for day-to-day operation.

- Retrieve your device setting files and organize them according to the asset being protected
- Manage documents such as data sheets, and engineer white papers related to your protection device assets
- Access and save setpoint files for your devices regardless if the device is offline or online



Site Reports

Enervista Launchpad software can be used to generate comprehensive site reports for your install base and provide recommendations useful to determine upgrade and maintenance schedules for your assets and protection devices. With the click of a button, you can download critical data, which includes:

- Hardware upgrades and replacement recommendations
- Firmware upgrade recommendations, if applicable
- Complete Installed based configured by age and device type

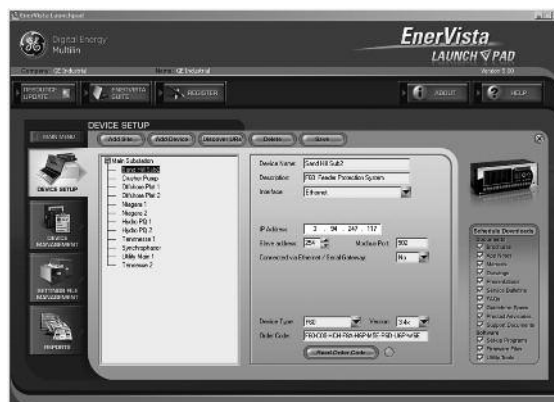


Device Setup

Organize your installed base devices with a single user-friendly interface.

Save precious time when establishing communications to your protection devices. Whether you have a small or large installed base, individual or networked connection, Device Setup will help you organize and manage your valuable assets:

- Manage your asset by organizing your site and protection device configurations
- Allows seamless communication with multiple devices
- Provides resources related to your protection scheme and individual protection device



A Complete Up-To-Date Reference Library

EnerVista™ Launchpad will make sure that all necessary documents, setup programs and software tools are up-to-date by automatically retrieving them from our web site or Product CD, or by sending you an email whenever new information is available.

Manage all of your Support Documents in a Single Desktop Library

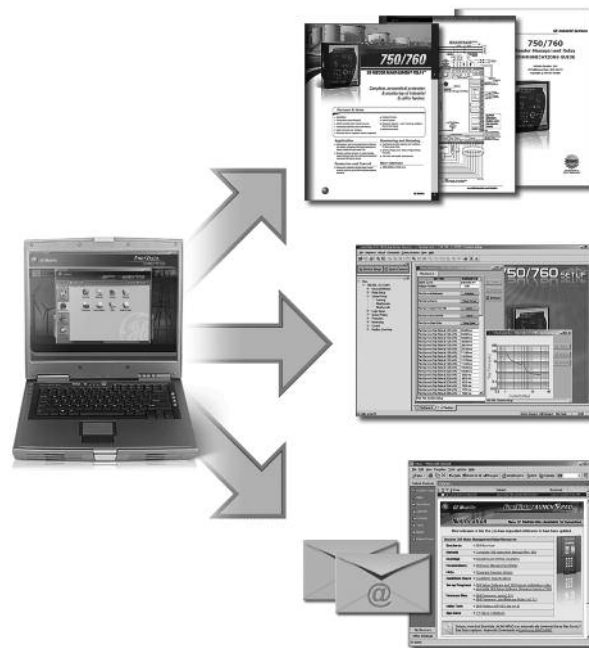
Launchpad offers a complete library of document resources that is automatically updated and organized for you.

The Document Library includes:

- Manuals
- Application Notes
- Service Bulletins
- Guideform Specifications
- Drawings
- Support Documents
- FAQ's
- Brochures

Launchpad's subscription application will keep you up-to-date on the new product resources as soon as they are available. Launchpad will allow you to sign up to receive notification about new information by one of the following methods:

- Alerting you whenever you open up EnerVista™ Launchpad
- Emailing you about the new resource available
- Automatically downloading new documents into Launchpad

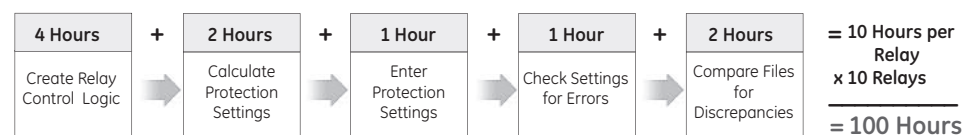


All critical information about Multilin products will be up to date and at your fingertips

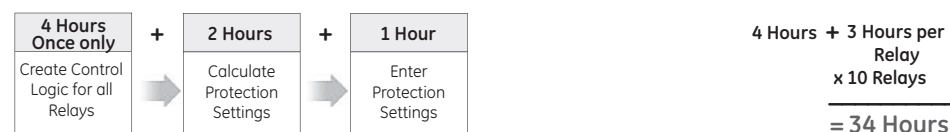
Create Templates to Reduce Configuration Time

The template creation tool included with EnerVista™ Launchpad will greatly reduce the amount of time required to configure relays that are performing similar functions. The example below demonstrates how the time required to configure 10 similar relays can be reduced by up to one third using Launchpad templates.

Traditional Device Configuration Method



Launchpad Template Configuration Method



System Configurator and Commissioning Toolset

Viewpoint Engineer is a set of tools that will allow you manage, configure, and test your UR and UR^{Plus} relays at a system level in an easy to use graphical drag-and-drop environment. This software will streamline the steps required to configure devices, commission relays and manage the assets in your power system.

Key Benefits

- Reduce the amount of time required to create complex logic schemes
- Configure your IEC61850 devices at a system level using a single application
- Program Remote I/O communications for multiple relays in an intuitive graphical interface
- Simplify commissioning by identifying the status of the relay logic in real-time
- Test protection relaying at a system or substation level rather than as an isolated device
- Provides a means for managing all documentation about all assets in your substation
- Decreases the number of support documents engineers require for commissioning and maintenance
- Full online functionality including uploading and downloading of settings files, actual values and event record metering and monitoring, and firmware updates

Key Features

- Configure UR, UR^{Plus} and MM300 relays in an intuitive Graphical environment.
- Program Remote I/O relay communication settings for multiple devices in one simple step
- Evaluate the status of Flexlogic™ equations and Remote I/O messaging in real time
- Annotate UR, UR^{Plus} and MM300 settings and store this documentation in the setting file.
- Link support documents to the System Designer Project to create a single location for substation asset management
- Reduce integration time by automatically detecting and configuring your UR devices

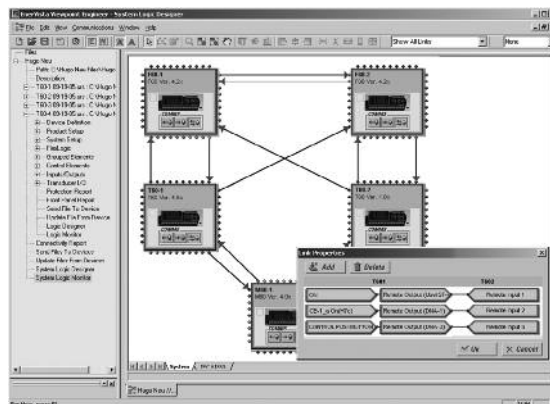
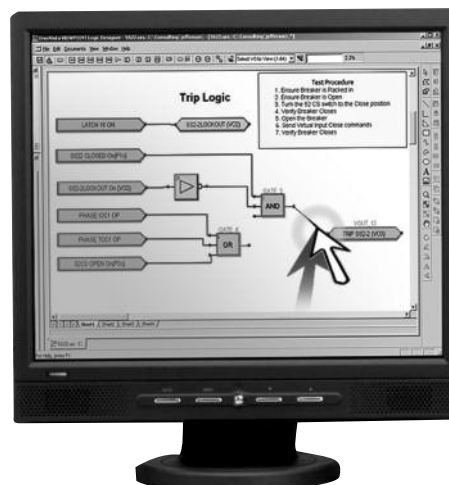
System Designer

Design Control Logic at a System or Substation Level

The System Designer allows you to inter-connect the control logic distributed across multiple UR and UR^{Plus} devices by programming Remote I/O messages in an intuitive, graphical drag-&-drop environment.

System Level Settings Configuration

- Design automation logic distributed across multiple UR and UR^{Plus} devices
- Configure Remote I/O messaging in both the Sending and Receiving devices in one simple step
- View “Virtual Wiring” communication diagrams in a manner that is similar to hard wiring schematics



Configure Remote I/O communications for multiple relays in one easy drag-&-drop step

Multiple Setting Files Created

- Configure the settings for multiple UR and UR^{Plus} devices at one time
- A separate setting file will be created for each UR device used in the System Logic Designer



Connectivity Report

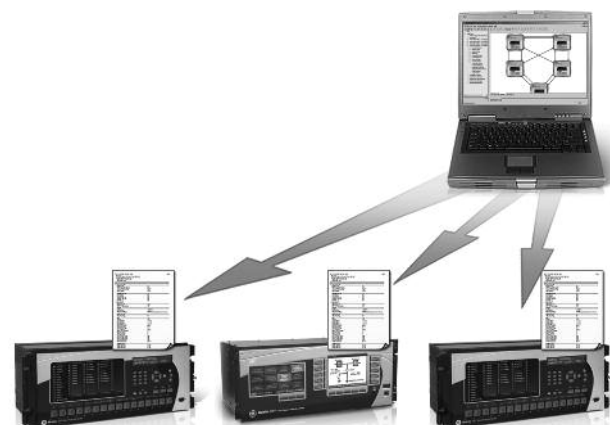
The connectivity report provides a detailed report of all peer-to-peer mappings between the settings files associated with a project, including:

- IEC61850 GSSE/GOOSE and UCA2 GOOSE messaging
- Direct I/O configured between the UR relays.

The report will be generated as a PDF for simple archiving and emailing. A separate PDF report will be generated for each UR or UR^{Plus} device

Document System Level Setting Diagrams

- Annotate Remote I/O System diagrams to describe Inter-Relay messaging for testing engineers
- Documentation of Remote I/O System diagram stored in a project folder for permanent archiving



Viewpoint Engineer will create a separate setting file for each UR or UR^{Plus} device that is configured in the System Designer. These setting files will contain all communication settings needed for Remote I/O communications.

IEC61850 Configurator

Import ICD and Generate SCD files using a single application

The IEC61850 enables system level configuration of the communications between all IEC61850 devices.

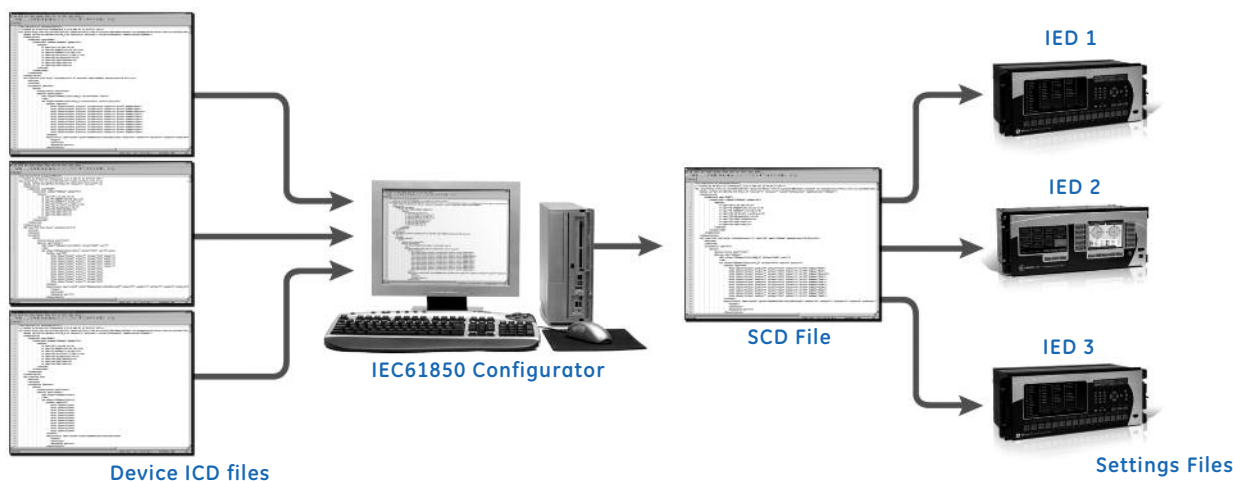
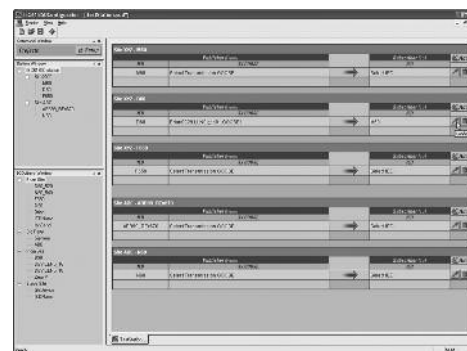
Importing ICD Files

- Import ICD files from any IEC61850 Compliant device
- Create a library of ICD files, organized by device location, device type, or project
- View file information in an easy to understand ICD viewer



Create SCD Files

- Organize files by creating projects. Project files contain all subnet communication parameters as well as the associated device ICD files
- Configure the communications between relays by having the IED's subscribe to the appropriate transmission GOOSE messages
- The saved project becomes the SCD file needed to generate the GOOSE reception settings files for the IED's in the system



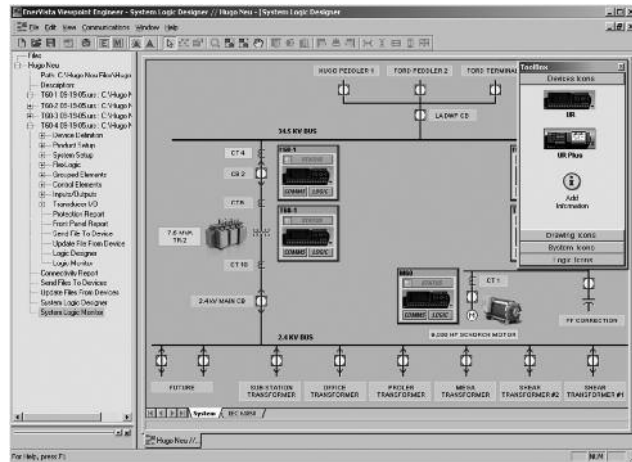
Asset Manager

Manage all Assets in Your Substation or Power System

The Asset Manager will provide you with a tool to archive and manage critical information about any asset in your substation. All information in your power system can be stored in a Project Folder that can be shared between engineers and act as a single repository for any information required for your installed equipment.

Central Link to all Critical Information

- Create a Project folder that will act as a single location to reference all information about equipment in a substation
- Create an intuitive layout and navigation interface for your project by importing existing schematics or using the drawing tools provided
- Link documents, drawings, or setting files for all substation equipment into the project for complete system asset management
- Launch directly from the Asset Manager into the System Designer or Graphical FlexLogic™ Designer for programming your devices



Create a Project that will identify, document, and archive information about all assets in your substation (relays, breakers, transformers etc.)

Graphical FlexLogic™ Designer

Design FlexLogic™ with Drag-&-Drop Ease

Simplify the process of creating complex control logic for substation automation in your UR, UR^{Plus}, and MM300 relays to perform functions such as advanced tripping, reclosing, interlocking, and transfer schemes.

Simplified Control Logic Creation

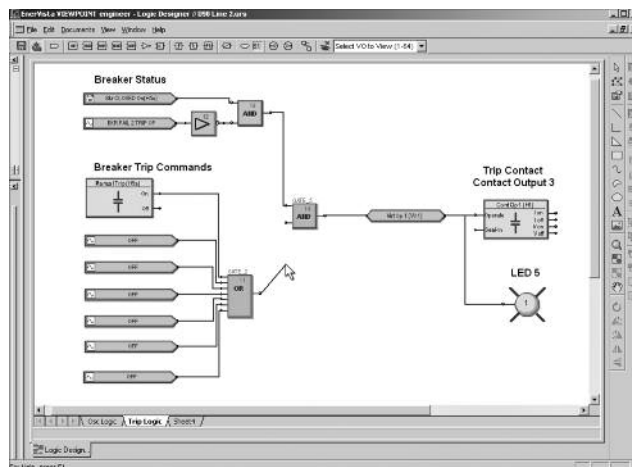
- Create FlexLogic™ with drag-and-drop ease
- Connect outputs of FlexLogic™ equations directly to contact outputs and LEDs
- Configure logic over multiple worksheets to keep logic structured and organized

Documentation of Settings

- Annotate control logic with documentation and graphics
- Store all settings documentation directly in UR and UR^{Plus} setting files

Powerful Intuitive Compiler

- Optimizes FlexLogic™ equations to use as few lines as necessary
- Detects and alerts user of errors and problems in FlexLogic™ design



Design and document UR control logic in one intuitive application



MM300, Universal Relay, and UR^{Plus}

Logic Analyzer

Real-Time Feedback of FlexLogic™ Status

When connected to your UR, UR^{Plus}, and MM300 relays, Viewpoint Engineer will provide real-time feedback of the status of the Flexlogic™ inputs, logic gates, timers, latches and outputs for every equation in the relay.

Simplified Troubleshooting

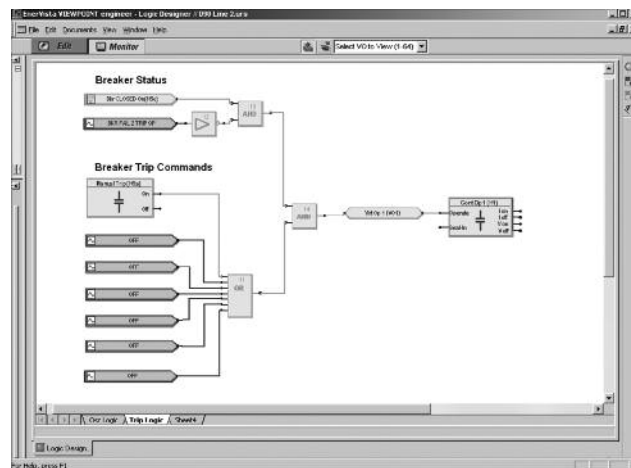
- Follow the operation of your UR relay through each step of the FlexLogic™ equations
- Detect problems in wiring or programming by viewing the status of all inputs in one screen
- Determine which inputs are causing each logic gate to be asserted
- Identify the logic that is causing the relay to not act as expected

Real-Time Feedback of Peer-to-Peer Message Status

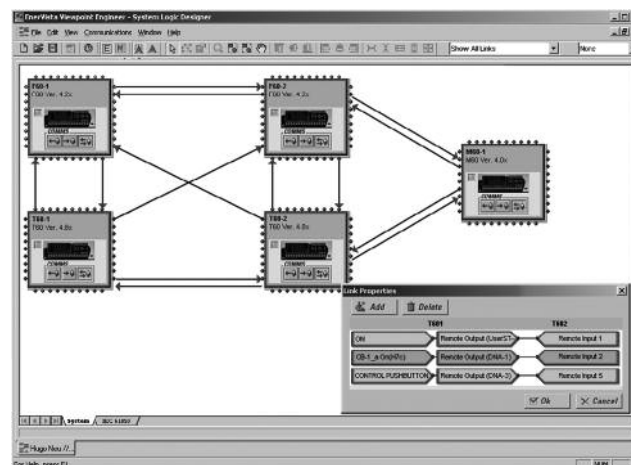
Connecting Viewpoint Engineer to the local area network allows you to receive real-time feedback of the status of Remote I/O messages from both the relay sending the message and the relay receiving the Remote I/O message.

Simplified System Troubleshooting

- Determine the status of all Remote I/O messages sent to other devices in the network
- Verifies that Remote I/O signals are received and interpreted correctly by the intended devices
- Reads settings from UR and UR^{Plus} devices on the network and automatically creates a Remote I/O System Diagram
- Analyzes the settings in all UR and UR^{Plus} devices and verifies correct programming between sending and receiving devices



Relay internal logic represented visually to simplify commissioning and troubleshooting



Analyze the status of Remote I/O messages from both the Sending and Receiving devices in Real- Time

Viewpoint Engineer Software Selection Guide

VPE VPE - UR Plus VPE - MM300	*	*	*	Viewpoint Engineer for UR Relays Viewpoint Engineer for UR Plus Relays Viewpoint Engineer for MM300 Relays
1 5 10 50				Single License 5 Pack 10 Pack 50 Pack
		S		No System Designer System Designer Option/IEC61850 Configurator
			G1	Additional 1 Year Updates



Relays and Meters Software EnerVista™ Viewpoint Maintenance

Section 22

Troubleshooting and Reporting Tools

Viewpoint Maintenance is a must-have tool for any integrators or electrical staff involved in power system protection and maintenance. This software increases the security of your relays, reports your device's operating status and simplifies the steps to troubleshoot your device.

Key Benefits

- Reduce the time required to perform maintenance on your device
- Increase the security of your relays by identifying relay settings that have been changed
- Avoid costly downtime by reducing the time required to collect data for troubleshooting faults
- Improve maintenance scheduling by prioritizing service needed for your power system equipment
- Identify potential system problems before they become critical

Key Features

- Security Audit Trail tracks settings and configuration changes, who changed them, and the time and method of the change
- Single button click to download and compile all fault diagnostics into a single zip file for easy sharing with engineers who can help assess system problems
- Retrieve critical system information that will help assess potential system faults
- On-line and hard copy reports for easy viewing
- Easily identify the file name of the settings file loaded on the relays
- Support for the following GE Multilin IEDs: MM300, 350, 369, 469, 489, 745, 750/760, PQM II, B30, C30, C60, C70, C90 Plus, D30, D60, D90 Plus, F35, F60, G30, G60, L30, L60, L90, M60, N60, T35, T60*

*Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



Security Audit Trail*

The Security Audit Trail feature in Viewpoint Maintenance is the first of its kind, automatically tracking the details of settings changes to your relays along with the MAC address of the user who changed them. This traceability helps map out where a problem may have occurred and will help improve maintenance procedures to prevent them from happening again. This is also a valuable tool for ensuring the system configuration is the same as when it was commissioned.

Security Audit Trail Features:

- Date and time of hardware, firmware or setting changes made to your relays
- Logging of the MAC address of computers making settings changes
- Track method of how settings changes were made (i.e. keypad, serial port, Ethernet)
- Printer-friendly option to view hard copy reports
- Filter by date to identify changes to settings over time
- Ability to identify the name of settings files for accurate identification

EAST LANE 2 SECURITY/CHANGE HISTORY REPORT

Generated at: Sep 09 2005 14:30:40

Device Summary

Device Name:	East Lane 2
Device Type:	UR L90
Order Code:	L90-H03HDH-H6A-WYC
Firmware Version:	4.60
Serial Number:	MAGC0400000127
IP Address:	3. 94.247.167

Settings Summary

Setting File Name:	FAST_LINE-2.urs
Last Changed:	Sep 09 2005 14:18:03.070200 via Ethernet
Changed by Whom (MAC Address):	0008742D6FD0

Setting Changes History

Event	Date of Change	# of Changes	Password Entered	Method of Change	Changed by Whom (MAC address)	Filename Uploaded	Status	Firm. Version
144	09/09/05 02:18 PM	15	No	Ethernet	0008742D6FD0	FAST_LINE-2.urs	In Service	4.60
143	08/26/05 09:15 AM	1	No	Keypad			In Service	4.60
142	08/25/05 08:29 AM	1	No	Keypad			In Service	4.60
141	08/25/05 06:02 AM	1	No	Keypad			In Service	4.60
140	08/24/05 09:45 AM	18	No	Ethernet	0080D0D2EA63	FAST_LINE-2.urs	In Service	4.60
139	08/09/05 05:12 AM	3	No	Ethernet	0080D0D2EA63		Out of Service	4.60
138	08/09/05 03:12 AM	16	No	Ethernet	0080D0D2EA63		Out of Service	4.60
137	09/09/05 02:30 PM	22	No	Ethernet	0008749784BF		Out of Service	4.60
136	09/09/05 02:30 PM	12	No	Ethernet	0008749784BF		Out of Service	4.60
135	09/09/05 02:30 PM	3	No	Ethernet	0080D0D2EA63		Out of Service	4.60

Setting Changes Detail History

Event	Date of Change	Old Value	New Value	Item	Modbus Address
144	09/09/05 02:18 PM	Disabled	Enabled	Auxiliary UV 1 Events	0x6620
144	09/09/05 01:10 PM	Disabled	Enabled	Auxiliary UV 1 Function	0x6620
144	09/09/05 12:45 PM	Disabled	Enabled	Neutral OV 1 Events	0x6900
144	09/09/05 12:10 PM	0.300 p.u.	0.55 p.u.	Neutral OV 1 Pickup	0x6900
144	09/09/05 11:05 AM	Disabled	Enabled	Neutral OV 1 Function	0x6900
144	09/09/05 03:05 AM	Not Programmed	Programmed	Relay Programmed State	0x43E0
144	08/24/05 09:49 AM	None	F5	Source x Auxiliary VT	0x458A
144	08/24/05 03:05 AM	None	F5	Source x Phase VT	0x458A
144	08/24/05 01:12 AM	None	F1	Source x Ground CT	0x458A
144	08/23/05 11:20 PM	None	F1	Source x Phase CT	0x458A
144	08/23/05 09:10 PM	None	F5	Source x Auxiliary VT	0x4583
144	08/23/05 06:33 PM	None	F5	Source x Phase VT	0x4583
144	08/23/05 04:15 PM	None	F1	Source x Ground CT	0x4583
144	08/23/05 02:21 PM	None	F1	Source x Phase CT	0x4583
144	08/23/05 02:02 PM	1.00:1	24000.00:1	Phase VT x Ratio	0x4502
143	08/23/05 01:10 PM	1A	65000A	Phase CT x Primary	0x4480
142	08/23/05 12:30 PM	Off	SRC 2 Pc	Data Logger Channels	0x418C
141	08/23/05 11:21 AM	Off	SRC 2 Vbg RMS	Data Logger Channels	0x418A
140	08/23/05 11:01 AM	Off	SRC 1 Vbg RMS	Data Logger Channels	0x418B
140	08/23/05 10:10 AM	Off	SRC 2 V_1 Angle	Data Logger Channels	0x4186
140	08/23/05 06:19 AM	Off	SRC 1 Vca RMS	Data Logger Channels	0x4184

- Date and Time that the Security Report was generated
- Description of the GE Multilin Relay
 - Equipment Name
 - Relay Model Number and Firmware version
 - Relay Serial Number
- Summary of the last time the configuration was changed
 - Name of settings file
 - Who loaded the file
 - When the file was loaded
- History of last 10 occurrences the configuration was changed
 - Date and time of configuration change
 - Number of settings changed at this time
 - Method used to change the relay settings
 - MAC address of computer sending settings
 - Name of the setting file sent to the Relay
 - The relay status after the settings changes
- Detailed description of all changes made to the relay's configuration
 - Date and time of configuration change
 - Description of the setting that was changed
 - Setting value before change was made
 - Setting value after change was made
- Convenient File Format
 - On-line and off-line copies
 - Easily zip these reports with other pertinent files such as settings files and fault reports to share with engineers

Supported in the following GE IED devices: UR, UR^{plus}, 350, 369, 745

*Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



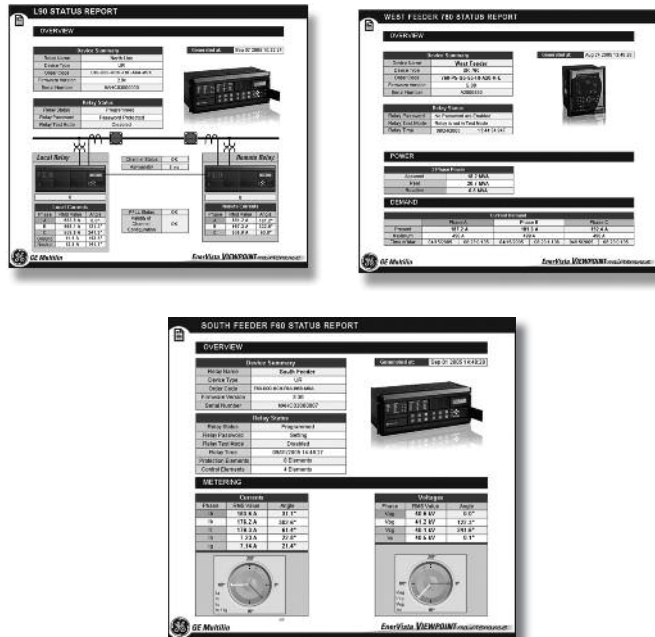
Device Status Reports*

Reduce the time required to perform maintenance on your device by receiving a report that shows the health and operating status of your relays, meters, and the power system being monitored.

Status Reports Include:

- Current operating condition of the GE Multilin™ device
- Operating status of the equipment being protected
- Critical device settings that have not been programmed
- Operating history of the monitored devices
- Maintenance issues that need to be addressed
- LED simulated view of equipment targets and alarms detected

* Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



Pump Motor 1 SR469 Status Report

OVERVIEW

Device Summary	
Device Name	Pump Motor 1
Device Type	SR 469
Order Code	SR469 P5 III A20 E
Firmware Version	2.9
Serial Number	A3002550

Generated at: 03/09/2005

Relay Status	
Relay Password	Password Protected
Relay Test Mode	Test Mode Off
Relay Time	10:24 05/09/2005
Protection Elements	No Elements are enabled

Status: IN SERVICE

MOTOR STATUS

Motor Status	
STOPPED	
STARTING	
RUNNING	
OVERLOAD	
UNBALANCE	
GROUND	
HOT RTD	
LOSS OF LOAD	

Motor Load	
Motor Load	73%
Current Unbalance	4%
Unbalanced Biased Load	3%
Thermal Capacity Used	56%
Estimated Time to Trip	Never

Stator Differential Currents	
A Differential	20.4 A
B Differential	18.3 A
C Differential	19.6 A

Hottest Stator	
RTD	5
Temperature	180°F
Frequency	60.01 Hz

MOTOR ANALYSIS

Motor Running Hours	
Motor Running Hours	1206 Hrs
Time Between Starts Timer	43 mins

Motor Starts	
Number of Motor Starts	23
Number of Emergency Restarts	1

Starter Information	
Number of Starter Operations	25

Start Timer	
Start Timer 1	3.6 s
Start Timer 2	3.7 s
Start Timer 3	3.8 s
Start Timer 4	3.3 s
Start Timer 5	4.8 s

- Date and Time that the Status Report was generated
- Description of the GE Multilin Relay and equipment being protected
 - Equipment Name
 - Relay Model Number and Firmware version
 - Relay serial Number
 - Intelligent Reporting raises red flags to draw attention to disabled protection or control elements
- Equipment Targets and Alarms detected by the relay
 - Motor Overload
 - Hot RTD Alarm
 - Loss of Load
- Current Operating Condition of the equipment
 - Motor Speed
 - Transformer Load
 - Tap Changer Position
 - Estimated Time to Trip
- Critical information that can aid in anticipating faults
 - Differential Currents
 - Temperature
 - Frequency
- Historical Information about the asset that aids in predicting maintenance requirements
 - Motor Running hours
 - Accumulated Loss of Life
 - Number of Breaker Operations



Comprehensive Fault Diagnostics*

Reduce time required to collect data for troubleshooting a fault with Viewpoint Maintenance. There is no need to access the setup program for the device or sift through settings to figure out what data is needed. With the click of a button, Viewpoint Maintenance will gather the required information including pertinent settings files, oscillography, events, fault reports, data logger and health reports and package it into a single zip file to allow for easy sharing with engineers to assist with your fault analysis.

Fault Diagnostics Features:

- Effortlessly collect the data required to diagnose a fault
- Automatically package all pertinent information into a .zip for easy file sharing
- Eliminate costly hours of troubleshooting by filtering data at the click of a button
- Assess why and how the fault occurred to improve preemptive maintenance procedures
- Avoid costly downtime and customer interruptions
- Reduce the amount of time required to troubleshoot a fault to get your system back up and running



Viewpoint Maintenance Software Selection Guide

VPM	*	*	EnerVista™ Viewpoint Maintenance
1			Single License
5			5 Pack
10			10 Pack
50			50 Pack
	G1		Additional 1 Year Updates

* Consult the latest Viewpoint Maintenance release notes for a complete list of devices supported by this function.



Relays and Meters Software

EnerVista™ Viewpoint Monitoring

Section 22

Easy to Use Monitoring and Data Recording

EnerVista Viewpoint Monitoring is an easy to setup, powerful and simple to use data monitoring and recording software application for electrical systems.

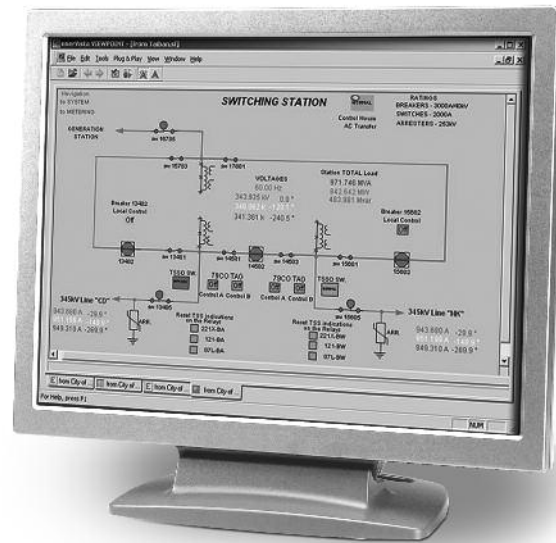
With minimal configuration required to communicate with field devices directly, Viewpoint Monitoring provides an overall view of the entire power system and collects critical real-time and historical disturbance data to assist with analyzing past or impending power system events.

Key Benefits

- Easy start up and configuration saves time and cost by integrating devices using pre-programmed memory maps
- Automatically generated, user friendly monitoring screens provide instant remote equipment visibility
- Reduced integration time through automatic detection and configuration of UR devices
- Reduced fault analysis effort by centralizing critical fault data digitally
- Perform load analysis by recording and trending power equipment load levels
- Remote viewing of Viewpoint Monitoring systems using ViewNodes

Key Features

- Monitor up to 150 devices or 9000 data points
- Simplify the monitoring of devices from multiple vendors - IEC61850 option
- User friendly drag-and-drop construction of single-line monitoring screens
- Pre-configured memory maps of GE Multilin devices
- Single-line monitoring and control
- Trending of up to 500 power system data points with 1 minute resolution
- Communicate with third-party Modbus compliant field devices
- Plug-and-Play analysis of power system equipment
- Automatic collection of events and waveforms from GE Multilin devices
- Annunciator alarming with visual, audio and email notification
- Diagnose waveform fault data recorded in power system devices



Plug-and-Play Monitoring

Instantly View Device and Asset Monitoring Screens

EnerVista Viewpoint Monitoring's Plug-and-Play screens are a series of pre-configured modules for analyzing the health and status of your power system equipment. Viewpoint Monitoring will detect the devices you are using and automatically generate monitoring screens that are tailored to your devices as well as wiring configurations. This saves hours of engineering effort and enables quick setup to monitor protection devices.

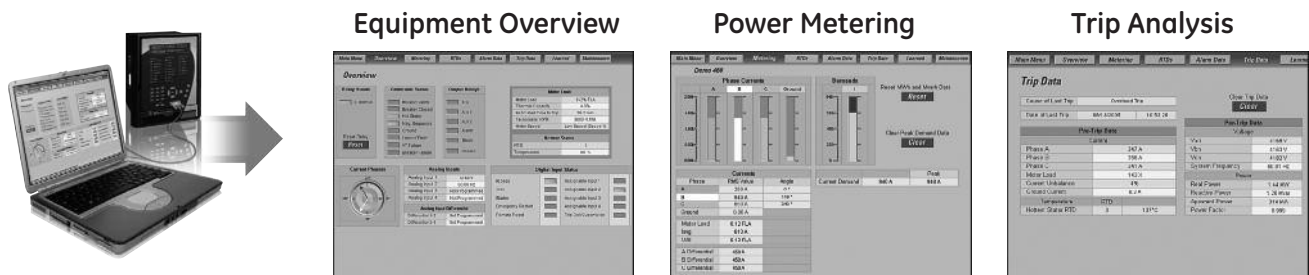
Auto-Discovery of Devices

Viewpoint Monitoring reduces integration time and decreases errors when configuring devices by automatically detecting and configuring UR devices.

Viewpoint Monitoring Advantage

Viewpoint Monitoring Reduces Commissioning Effort Saving Time and Cost

The following is an example of connecting and communicating with a 469 Motor Protection Relay to monitor relay and motor data:



Overview

- Operating condition of your motor
- Status of your GE Multilin™ Relay

Metering

- All metering quantities (Amps, Volts, Power, Demand)
- Motor temperature monitored by the RTD's

Alarms

- Active Alarms detected by the relay
- Latched Alarms that require clearing

Trip

- Cause of the last motor trip
- Pre-trip data

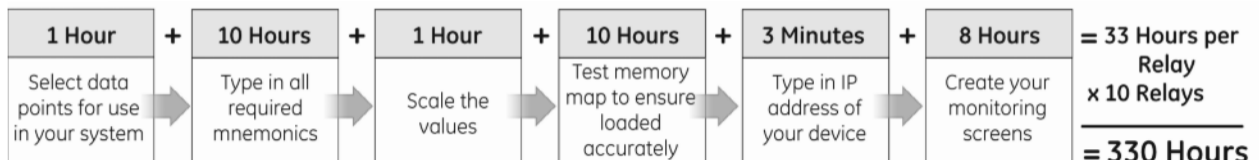
Learned

- Learned motor and RTD data
- Learned motor load

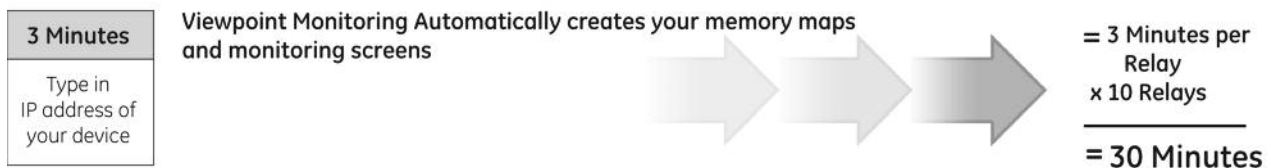
Maintenance

- Trip counters and motor starts
- Total motor running hours

With other HMIs



With Viewpoint Monitoring



Plug-and-Play Motor Monitoring

Use Viewpoint Monitoring to Monitor Motor Protection Equipment

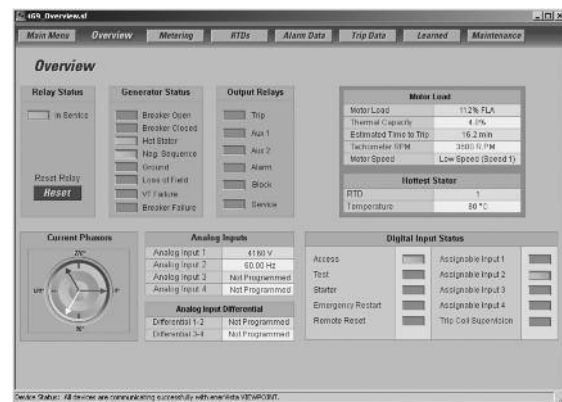
Instantly created overview screens provide insight on motor operating conditions and the status of GE Multilin relays. There are additional available monitoring screens that show the value of all metering quantities, the motor temperature monitored by the RTDs and any alarms that have been detected by the relay. Vital information and insight such as the cause of the last motor trip, operating information the relay has learned about the motor and any maintenance issues that may need addressing can be determined using historical data shown on available screens.

Instantly view critical information such as:

- Number of motor starts
- Learned motor starting current
- Motor running hours
- History of motor trips
- Real time power quantities (amps, motor load)
- Motor temperature

Supported Devices

- M60 Motor Protection System
- 469 Motor Protection System
- 369 Motor Protection System
- 269 Motor Protection System
- 239 Motor Protection System
- MM200/MM300 Motor Management System
- MM2/MM3 Intelligent MCC Controller
- SPM Synchronous Motor Protection System
- RRTD Remote RTD Module



View motor status using digital inputs, analog inputs and RTD inputs

Plug-and-Play Transformer Monitoring

Use Viewpoint Monitoring to Monitor Transformer Protection Equipment

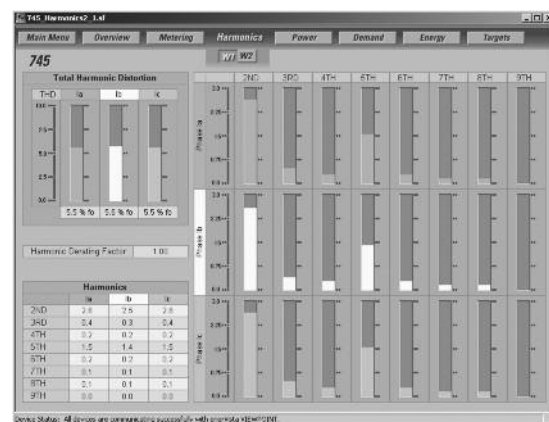
The operating condition of the transformer and the status of the GE Multilin relay are shown through instantly pre-created overview screens. Additional monitoring screens allow further analysis of transformer status by viewing the metering, power, demand, energy and harmonic data that is being measured by the associated relay.

Instantly view critical information such as:

- Transformer energization status
- Real time power quantities (amps, transformer loading, demand)
- Current harmonic analysis
- Accumulated loss of life
- Tap changer position
- Hottest transformer winding temperature

Supported Devices

- T60 Transformer Protection System
- T35 Transformer Protection System
- 745 Transformer Protection System



Monitor total harmonic content in each phase for all windings



Plug-and-Play Generator Monitoring

Use Viewpoint Monitoring to Monitor Generator Protection Equipment

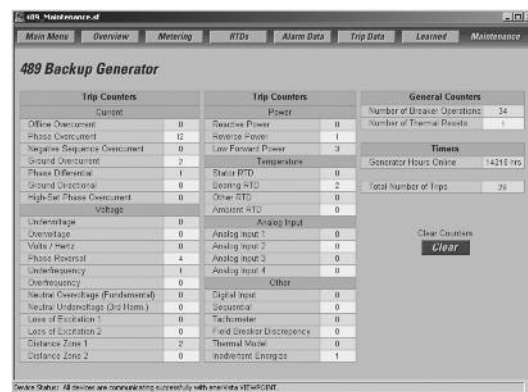
Instantly created overview screens provide insight on generator operating conditions and the status of GE Multilin relays. Further generator analysis can be performed with additional monitoring screens that monitor the value of all metered quantities, the generator temperature monitored by RTD's and any alarms that have been detected by the relay. Additional screens also provide historical information indicating cause of the last generator trip, operating information the relay has learned about the generator and any maintenance issues that may need addressing.

Instantly view critical information such as:

- Generator loading
- Real time power quantities (amps, volts)
- Cause of trip data
- Generator running hours
- History of generator trips
- Generator temperature

Supported Devices

- G60 Generator Protection System
- G30 Generator Protection System
- 489 Generator Protection System



Improve maintenance efficiency by analyzing trip operations

Plug-and-Play Feeder Monitoring

Use Viewpoint Monitoring to Monitor Feeder Protection Equipment

Instantly created overview screens provide insight on feeder operating conditions and the status of GE Multilin relays. Additional monitoring screens are available for analyzing all metering quantities, along with the power, demand and energy values that may be measured by the relay. If supported by the relay, synchronism screens will also be available for helping to determine if it is safe to close the breaker and energize the feeder.

Instantly view critical information such as:

- Breaker status
- Accumulated breaker arcing current
- Real time power quantities (amps, volts, demand, energy)
- Synchronism data

Supported Devices

- F60 Feeder Protection System
- F35 Multiple Feeder Protection System
- 750/760 Feeder Protection System
- F650 Feeder Protection System
- 735/737 Feeder Protection System
- MIFII Feeder Protection with Recloser
- 350 Feeder Protection System



Easily monitor synchronism levels needed for reclosing of circuit breakers



Plug-and-Play Breaker Monitoring

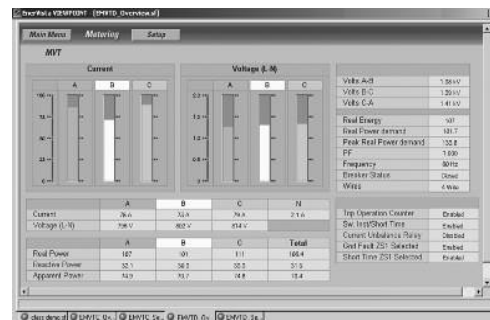
Use Viewpoint Monitoring to Monitor Breaker Equipment

Predefined screens allow instant setup and viewing of critical breaker information such as:

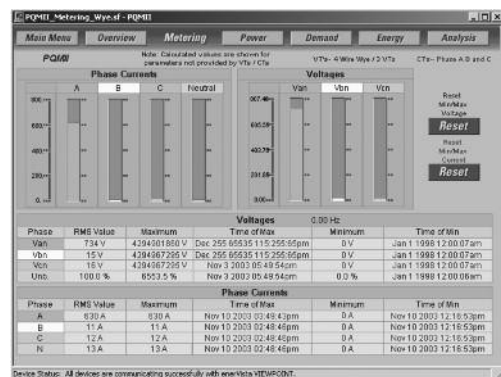
- Breaker status
- Number of breaker trip operations
- Real time current, voltage and power levels

Supported Devices

- MVT Microversa Trip Unit
- EMVT Enhanced Microversa Trip unit
- GTU EntelliGuard TU Trip Unit
- Entellisys Low-Voltage Switchgear



Monitor breaker equipment with predefined screens.



Instantly view the power quality status for critical devices.

Plug-and-Play Backup Power Monitoring

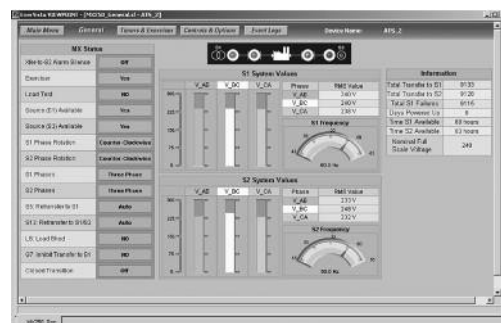
Use Viewpoint Monitoring to Monitor Critical Backup Assets

Instantly view critical information such as:

- Availability of normal and emergency power sources
- Status of power source connections
- Real time voltages and frequency
- Switch status, timer settings and control switch position
- Stored events and exerciser schedules

Supported Devices

- MX200 Controller
- MX150 Controller
- MX250 Controller
- MX350 Controller
- Lan Pro UPS
- SG-Series UPS



Monitor the status of critical backup assets.



Single-Line Monitoring and Control

View the Power System Status on Customizable Single-Line Diagrams

Viewpoint Monitoring provides the tools to easily create customized single-line diagrams providing monitoring and control. This powerful tool will communicate with supported devices and put the facility's energy system at your fingertips from either a local or a remote location.

Easily Create Customized Single-Line Monitoring Screens

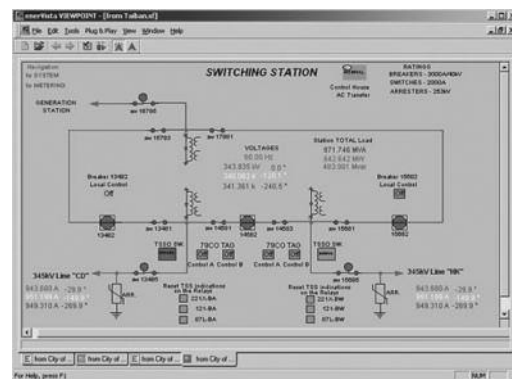
- Create single-line diagrams using user-friendly, drag-and-drop tools with standardized symbols and components representing power system assets (transformers, breakers, CT's and PT's)
- Import graphics to customize single-line diagrams and increase usability
- Display power system values and status with minimal configuration through pre-loaded memory maps
- Create customized or "virtual" monitoring points using the powerful Formula Editor

Monitor Power System Devices

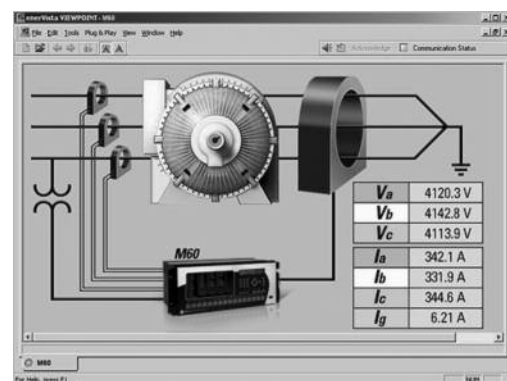
- Provide a system-wide view of the power system on one single-line monitoring screen
- Analyze the magnitude of all critical power quantities measured by devices
- Generate alarm warnings when measured values exceed configurable critical levels
- Create links to multiple monitoring screens to analyze power system equipment with greater detail

Control Power System Equipment from Remote Locations

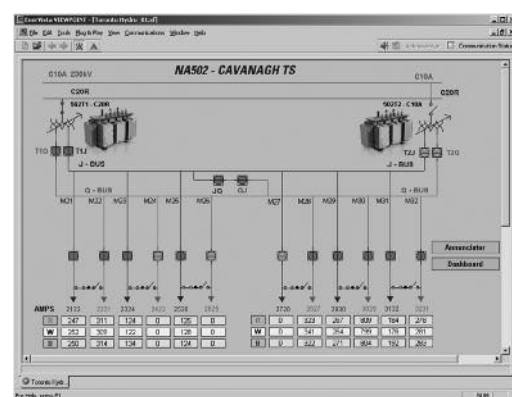
- Send commands to devices to control and change the status of power system equipment (breakers, switches, isolators)
- Enforces required two-step verification process to the operator sending the command
- Validates user's permissions by requiring passwords to be sent to protection relays or other devices before operation occurs



Easily create customized screens to monitor the power system state.



Monitor the motors status and loading throughout the facility from a centralized location locally or remotely.



Monitor the status of the entire power system and control components from one screen.



Automatic Event and Waveform Retrieval

Event Logging

Waveform Archiving

Event Viewing

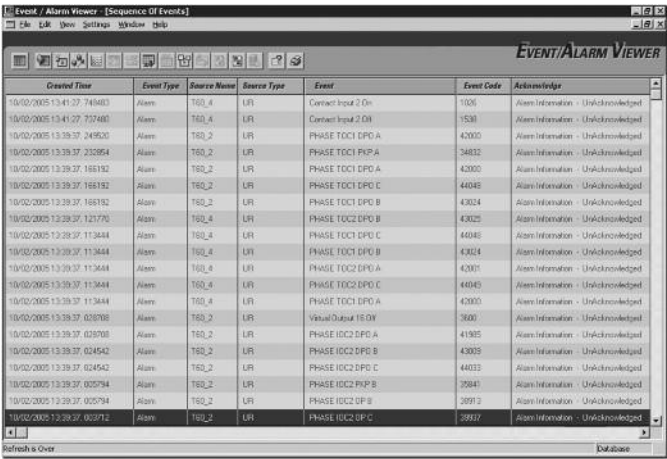
The Event Viewer centrally stores and displays information about preset and configured systems events. Each event in the record contains the following information. This data can be sorted by any of the fields indicated below:

- Event Time
- Event Type
- Source Name
- Source Type
- Event Cause

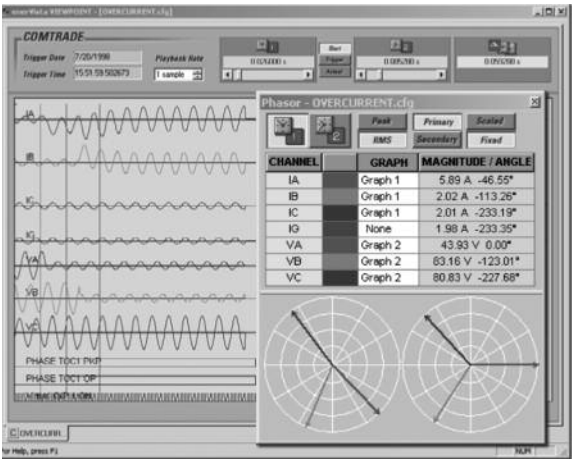
Waveform Viewing

View and analyze waveform fault data that has been recorded from a power system device in a time-based, phasor quantity or tabular view. This Waveform View utility provides functionality to:

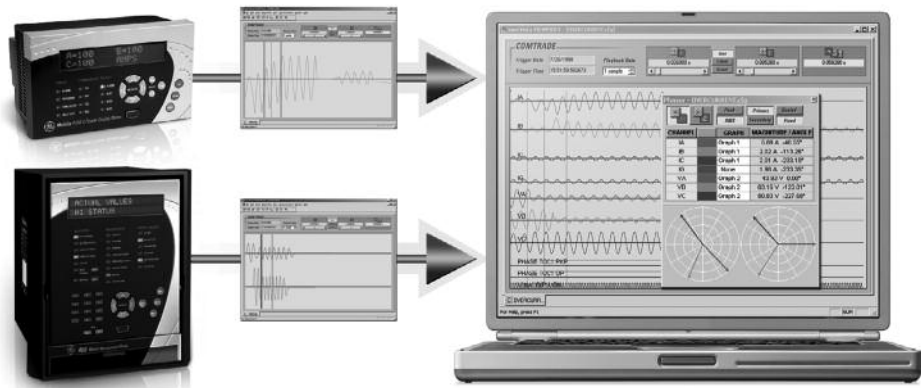
- Convert waveforms that were stored in Comma Separated Value (.CSV) format to COMTRADE compatible files (e.g. SR Family, PQM)
- Merge and overlay waveforms that were recorded from multiple devices
- Identify the harmonic content in the monitored parameters



Create comprehensive, centralized, system-wide sequence of event records for analysis of power system faults



View and analyze waveform fault data retrieved from devices.



Trending Reports

Create a Historical Archive of Monitored Data from Multiple Devices

Data Logging

- Log and trend the value of monitored analog or digital points
- View logged data for a pre-configured, customized recorded time period

Records

- Create up to 10 customized records
- Store up to 50 points per record for 500 points logged in total

Chart

- View logged data in a pre-configured, customized date range for trending analysis

Archiving Data

- Manually archive recorded data for storage onto network data repositories to reduce risk of data loss and decrease data storage requirements on local workstations

Exporting Data and Print

- Export data into an Excel format for easy data manipulation and analysis
- Print data that is logged in trending reports in a printer-friendly format

Third-Party Device Support

Viewpoint Monitoring supports communication with third-party devices that use Modbus RTU or Modbus TCP/IP communications protocols. This flexibility allows the use and provides monitoring functionality for other non-GE Multilin devices that may be found in the facility.

Viewpoint Monitoring provides support for third-party devices as follows:

Single-Line Diagrams

- Read the status of digital point
- Read the value of analog data
- Send commands to control power system equipment

Annunciator Panel

- Present an alarm when analog value surpasses a preset level or condition
- Present an alarm when a digital point(s) change state

Trending Reports

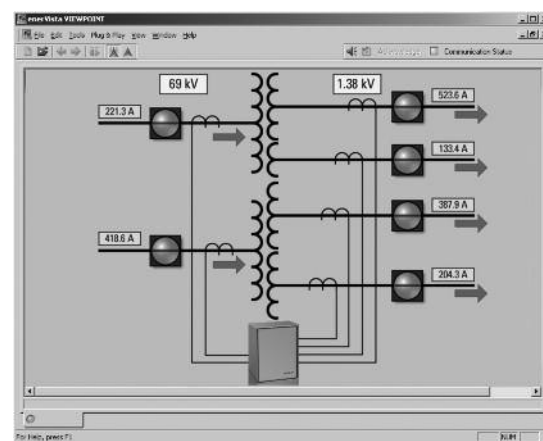
- Log the value of analog points over prolonged time periods
- Log the status of digital points on a device

Historical Record of Monitored Data

- Trend up to 500 data points
- Record data with 1 minute resolution
- View data in time based graphical or tabular format



Log power level data from multiple devices at one time.



Easily integrate third-party devices into single-line diagrams, annunciator alarms, and trending reports.



Annunciator Alarming

Receive Instant, Reliable Notification of System Alarms from Devices on the Network

Viewpoint Monitoring Annunciator Alarming actively monitors measured values and generates alarms. Alarms can be configured to be activated whenever a digital status changes state, or an analog value changes beyond any programmed threshold. Alarms can be delivered through multiple visual, audio, or e-mail notification channels. Furthermore, the Monitoring and Alarm Sentry ensures annunciators and alarms are always active.

Audio Notification

- Separate sounds for alert status and alarm status
- Audio notification of alarms and alerts continue until the alarm state is acknowledged by an operator

Visual Notification

- Annunciator screen shows the status of the monitored point
- The alarmed point will flash in a color chosen by the user until the alarm is reset by the operator

Email Notification

- Alarming of any monitored point can automatically generate an email to notify users of the alarm
- A different email address can be entered for each monitored point

Monitoring and Alarm Sentry

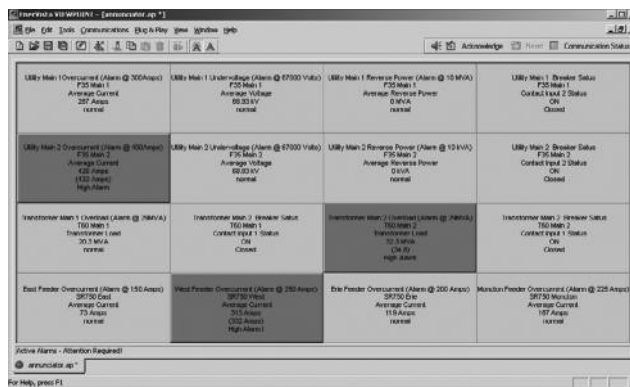
- Ensures annunciators and alarms are always active, even when the annunciator screens or the Viewpoint Monitoring software is closed in error

Reliable, Instant Alarm Notification

- Create alarms on monitored digital and/or analog data points
- Configured alarm warnings delivered through audio, visual or email notification channels

Instant Alarm Notification

- Create alarms on any monitored analog or digital data point
- Receive alarm warnings through audio, visual or email notification

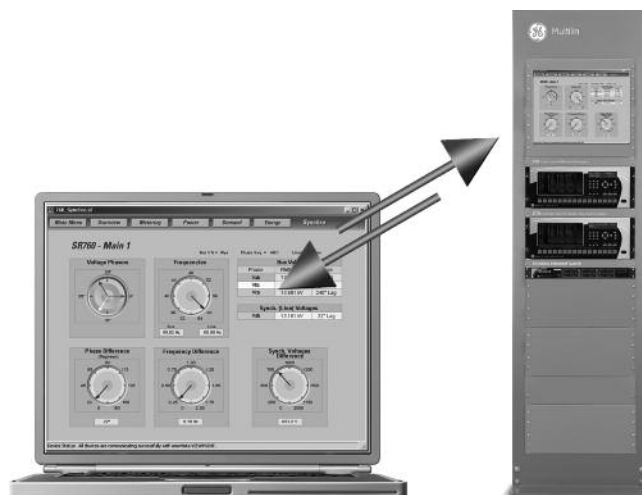


Reliable, instant notification of system alarms in a single visual dashboard view.

EnerVista Viewpoint ViewNodes – Remote Monitoring and Control

Remotely monitor and control Viewpoint Monitoring using EnerVista Viewpoint ViewNodes.

- Connect remotely to a Viewpoint Monitoring system over a network
- Implement security access and control by thorough user accounts with configurable permissions
- Provide complete access to:
 - Plug-and-Play screens
 - One-Line diagrams
 - Annunciator panels / trending reports
 - Events
 - Waveforms
- Connect up to 10 ViewNodes to a single Viewpoint Monitoring system



Relays and Meters Software

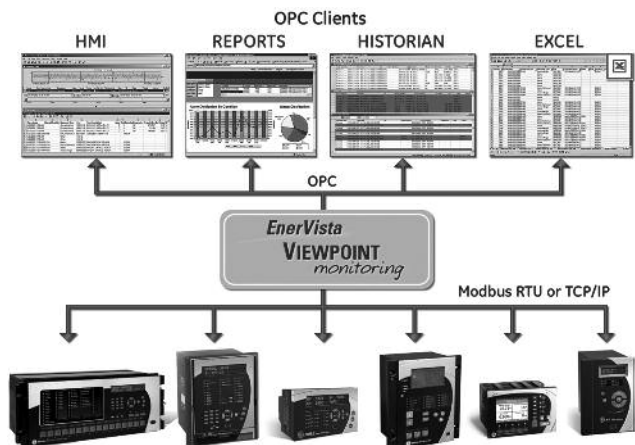
EnerVista™ Viewpoint Monitoring

OPC Server Option

Viewpoint Monitoring can send the data that is being read from the relays and meters to any third-party OPC compliant automation or monitoring system. With Viewpoint Monitoring's pre-configured memory maps of GE Multilin devices the time, effort and cost required to import essential data into your monitoring, automation and control systems is significantly reduced.

Integrate the data retrieved by Viewpoint Monitoring into a larger monitoring or automation system.

- Send up to 3000 data points (base package) or 9000 (extended package) data points to an OPC client
- Supports the entire library of devices that comes with Viewpoint Monitoring
- Provides the ability to send data from third-party devices added to the Viewpoint Monitoring database



Integrate the data retrieved by Viewpoint Monitoring into a larger monitoring or automation system

Viewpoint Monitoring Software Selection Guide

VP	*	*	*	*	*	Viewpoint Monitoring Base Package 50 devices/3000 points
	1					Single Pack
	5					5 Pack
	10					10 Pack
	50					50 Pack
		61850				No Additional Option IEC61850 Option OPC Server Option
			OPC			
				G1		No Upgrade Option Additional 1 Year Updates
					E	Extended Package Option 150 devices/9000 points

View Nodes

VPV	*	View Nodes
	1	Single Pack
	5	5 Pack
	10	10 Pack
	50	50 Pack



Comprehensive Communication Engine for Rapid Integration

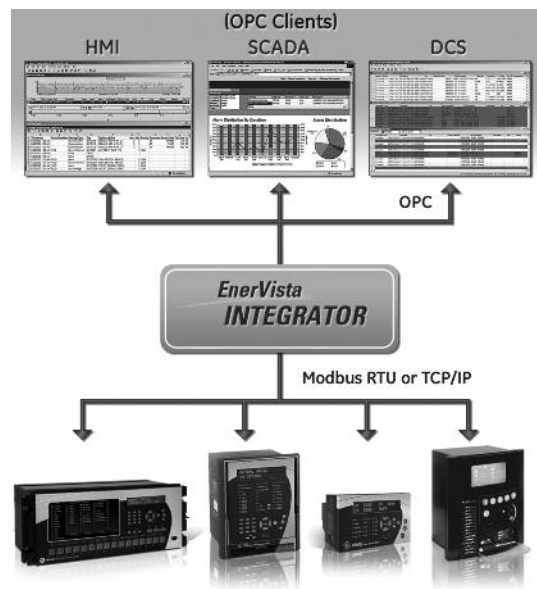
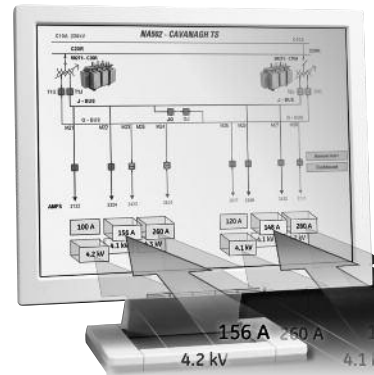
EnerVista™ Integrator enables seamless integration with GE Multilin devices for new or existing automation systems through tested, pre-configured memory maps. Integrator significantly reduces the time and effort required to obtain device, event and waveform data for integration with an HMI, SCADA or DCS system.

Key Benefits

- Reduces the effort and cost to integrate GE Multilin devices into new or existing HMI, SCADA or DCS systems
- Provides comprehensive, accurate and high quality data from devices
- Archives and centralizes fault data from relays and meters for fault analysis
- Supports integration of third-party (non-GE) Modbus devices into OPC compliant monitoring systems

Key Features

- Easy device setup through device communications
- Rapid retrieval of device, event and waveform data from GE Multilin devices for communication to OPC clients
- Comprehensive, factory tested memory maps for GE Multilin devices
- Scalable communication with up to 300 devices/30000 data tags (points)
- Reliable aggregation of event records from multiple GE Multilin devices into a single system wide Sequence-of-Event (SOE) record



EnerVista Integrator will efficiently link the information from GE Multilin and non-GE devices to monitoring, control and data collection systems.

Powerful OPC Server

EnerVista Integrator is designed to provide seamless integration of GE Multilin devices into any new or existing monitoring or control system. With tested, pre-configured memory maps for GE Multilin devices, EnerVista Integrator eliminates significant effort required for programming all of the mnemonics associated with HMI, SCADA and DCS system integration, greatly reducing the commissioning time and cost.

Device Setup

Configuring GE Multilin devices in EnerVista Integrator is achieved through establishing communication with the device.

- Supports user-friendly, intuitive configuration of devices similar to EnerVista Viewpoint Monitoring and EnerVista Setup software
- Provides configuration settings for both serial or Ethernet communications
- Tests communications to ensure accurate device configuration

Third Party Devices

EnerVista Integrator supports third-party (non-GE) devices that utilize Modbus RTU or Modbus TCP/IP, providing a simple way to incorporate all devices into a monitoring and control system.

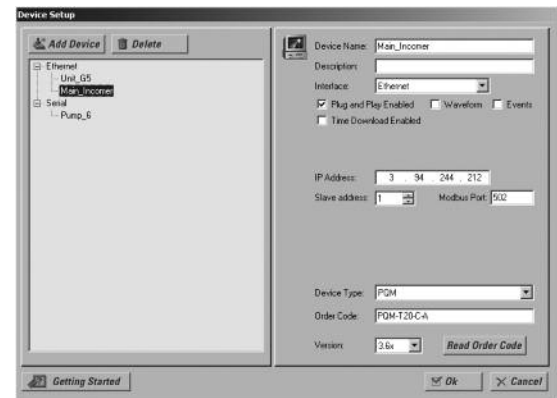
- Supports addition of Modbus RTU or Modbus TCP/IP third-party devices
- Provides direct configuration of Modbus mnemonics
- Results in reduced integration time for multiple installations of EnerVista Integrator by importing and exporting mnemonics files

Automatic Event and Waveform Retrieval

Automated archiving of event and waveform data from GE Multilin devices ensures that there is always comprehensive data available for diagnosing power system events.

Event Logging

The event records from GE Multilin devices can be automatically downloaded from each device and stored in a system wide sequence of events record. EnerVista Integrator will continually poll each GE Multilin device to see if any new events have been added to that device's event record. Once a new event has been detected, the event record will be downloaded from the device to the system wide sequence of events record.



User-friendly, intuitive setup similar to EnerVista ViewPoint Monitoring/Setup software to connect devices via OPC.

Event Viewing

The Event Viewer centrally stores and displays information about preset and configured systems events. Each event in the record contains the following information:

- Event Time
- Event Type
- Source Name
- Source Type
- Event Cause

This data can be sorted by any of the fields indicated above.

Event / Alarm Viewer - [Sequence Of Events]						
File Edit View Settings Window Help						
EVENT/ALARM VIEWER						
Created Time	Event Type	Source Name	Source Type	Event	Event Code	Acknowledge
10/02/2005 13:41:27.743483	Alarm	T60_4	UR	Contact Input 2 On	1026	Alarm Information - UnAcknowledged
10/02/2005 13:41:27.737480	Alarm	T60_4	UR	Contact Input 2 Off	1538	Alarm Information - UnAcknowledged
10/02/2005 13:39:37.243520	Alarm	T60_2	UR	PHASE TOC1 DPO A	42000	Alarm Information - UnAcknowledged
10/02/2005 13:39:37.003712	Alarm	T60_2	UR	PHASE IOC2 OP C	39937	Alarm Information - UnAcknowledged

Create a comprehensive, centralized, system wide sequence of event records for analysis of power system faults.



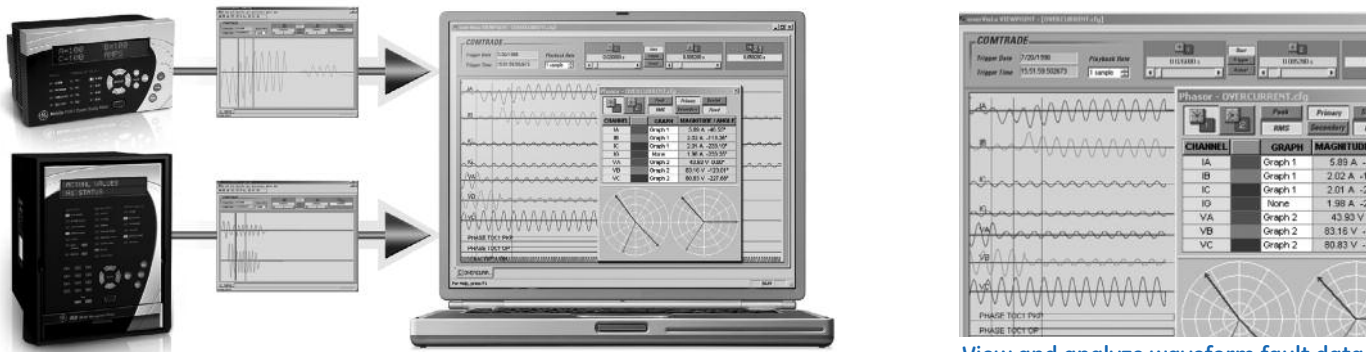
Waveform Archiving

The waveform (oscillography) files from GE Multilin devices can be automatically downloaded from each device and stored in a central data repository using Integrator. Similar to Event Logging, EnerVista Integrator will continually poll each GE Multilin device to see if any new waveform files have been created. Once a new waveform has been detected by EnerVista Integrator, the file will be downloaded from the device to the centralized data repository.

Waveform Viewing

View and analyze waveform fault data that has been recorded from a power system device in a time-based, phasor quantity or tabular view. This Waveform View utility provides functionality to:

- Convert waveforms that were stored in Comma Separated Value (.CSV) format to COMTRADE compatible files (e.g. SR Family, PQM)
- Merge and overlay waveforms that were recorded from multiple devices
- Identify the harmonic content in the monitored parameters



View and analyze waveform fault data retrieved from devices.

EnerVista Integrator Software Selection Guide

EVI	*	EnerVista Integrator
1000		1000 Point License OPC Server with Waveform and Event Server
5000		5000 Point License OPC Server with Waveform and Event Server
30000		30000 Point License OPC Server with Waveform and Event Server

EnerVista Integrator Add-On Packages

Cimplicity HMI		WonderWare InTouch HMI	
PLCMCSWCMLG01	EnerVista Integrator 30,000 Point License and GE Device Wizard Screens	PL50PMCSMWWG01	EnerVista Integrator 30,000 points and GE Device Wizard Screens for InTouch
PLCMPLMODBRTG01	EnerVista Integrator 30,000 Point License, GE Device Wizard Screens and Cimplicity Runtime License	PL50MODBRTG01	EnerVista Integrator 30,000 points and InTouch Runtime License
PLCMPLWIZG01	EnerVista Integrator 30,000 Point License, GE Device Wizard Screens and Cimplicity Development License	PL50PMCSWIZG01	EnerVista Integrator 30,000 points, GE Device Wizard Screens and InTouch Development License
PLCMPLVIEWERG01	EnerVista Integrator Waveform Viewer and Event Logger with Cimplicity ViewNode	PL50PMCSVIEWG01	InTouch Viewnode Waveform Viewer and Event Logger

Unlock the Full Potential of your Electrical Network

For utilities, building owners, plant managers, plant engineers and maintenance departments, it has become an incredible challenge to understand all aspects of increasingly complex facilities having an array of equipment and processes. Hard lessons on the importance of energy management are being learned across all business sectors in the form of:

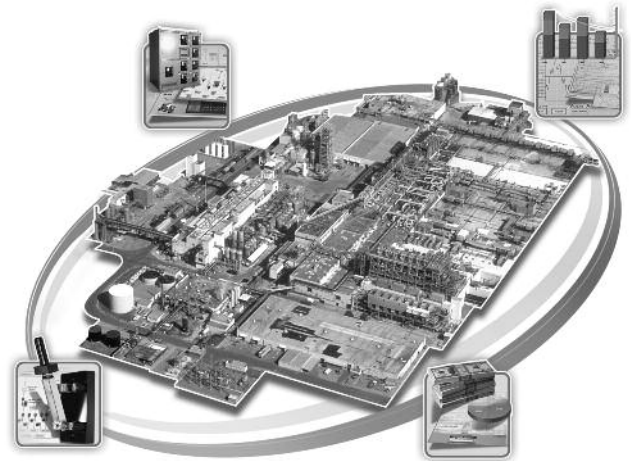
- Energy costs escalating out of control
- Revenue robbing process downtime
- Premature equipment failure
- Expensive system capacity upgrades

A large problem in facilities is the relative unknown about the use of energy and the power quality of the electrical network. The primary source of power and energy information comes from the few lines of data on the monthly power bill. Using only this, facility managers are being asked to develop strategies for energy savings, understand capacity profiles, and correct systems inefficiencies. Making decisions based on the 'final score' information of a power bill is a game plan for disappointment involving guesswork in analyzing problems, and implementation of trial & error solutions.

A clearer picture of exactly what is happening in a facility is a necessity. Data on not only the real-time status of a system, but also historical trending is essential, day-by-day, hour-by-hour, and minute-by-minute. For facility managers, the costly reality has been that what they don't know is hurting them. PMCS from GE Multilin™ is the tool to shift the thinking to "What you do know, can help you"

PMCS – Fully Integrated Energy Management Systems

Let GE Multilin™ help you shed some light on the unknowns of your system by providing a full, clear picture of your facility, and providing easy to use tools for implementing effective solutions. PMCS is a fully integrated Energy Management System that will reduce your cost of energy by optimizing the methods used to control both processes and equipment in order to utilize energy more economically and efficiently.

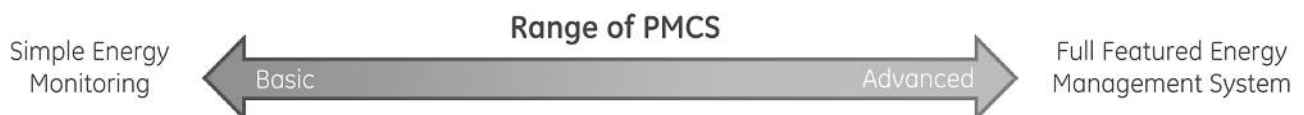


PMCS delivers a complete solution:

- Site Evaluation and Consultation
- Overall Project Management
- Complete Device Integration
- Communications Setup & Testing
- Site Specific Graphical Interfaces
- Hands On Training



PMCS (Power Management Control Systems) is a customized solution that can range from simple remote monitoring to a completely engineered automated control system. With PMCS you gain real-time access to GE Multilin™ Intelligent Electrical Devices (IEDs), as well as to many other installed third party devices and systems. Integrated with HMI client software, PMCS delivers the graphical representations of substation equipment status, energy trends, remote control of devices, and automated responses to system conditions.



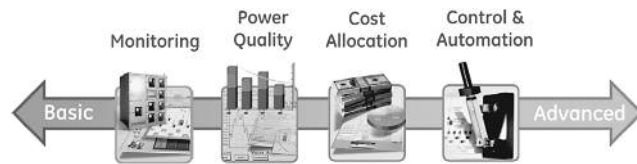
Relays and Meters Value Added Services PMCS Energy Management Systems

Section 22

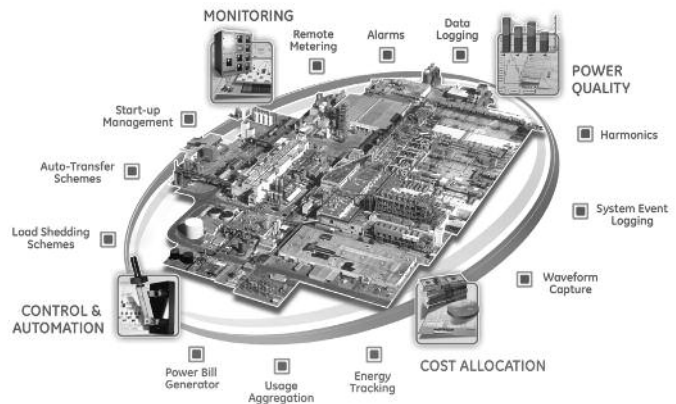
BENEFITS

PMCS provides the tools to control energy costs, minimize downtime and outages, and optimize operations to increase productivity.

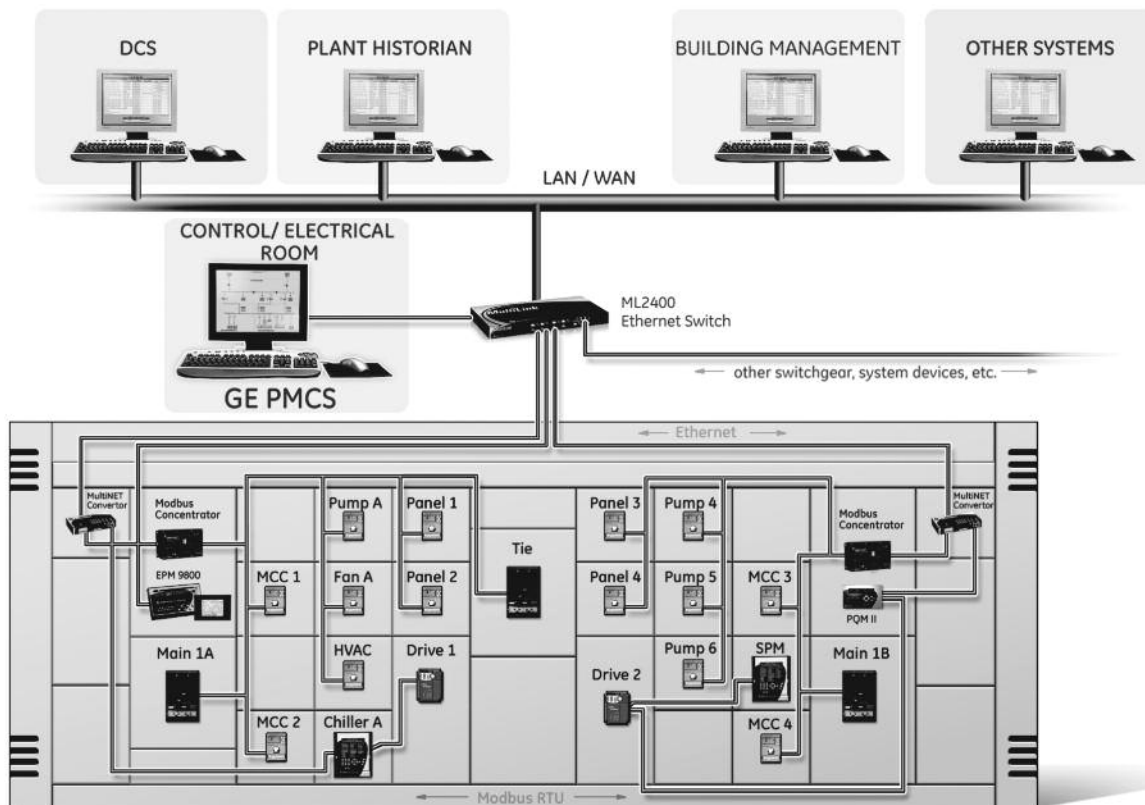
- Less downtime – Identify and correct problems before they lead to loss of power and/or costly damage to loads such as production equipment and computers.
- Reduced energy costs – Find ways to conserve power, correct billing errors, and reduce peak usage surcharges
- Improved predictive maintenance – Identify simple maintenance tasks so you can make scheduled corrections before they become problems.
- Faster corrective maintenance – Quickly pinpoint the root cause of problems using tools such as time-tagged alarms, sequence of events logs, and triggered waveform capture.
- Increased safety – Provide a centralized source of information, reducing the need for physical contact with equipment and reduce shop-floor or substation presence.
- Higher productivity – Free up maintenance and repair personnel to perform other needed duties.
- Improved power quality – Identify sources of “dirty” power, otherwise invisible, and take corrective action to save wear, and possible damage to critical production equipment and other loads.



PMCS delivers these benefits by implementing combinations of the four functional modules creating the most effective energy management system. The functional modules are Monitoring, Power Quality, Cost Allocation, and Control & Automation.



Multiple Devices, Multiple Protocols . . . One Easy to Use System



Relays and Meters Value Added Services Advanced Training Services

Section 22

In today's world of rapidly advancing technology and product innovation, GE Multilin™ is committed to providing our customers with the high quality training they need to be safe, efficient, and successful. With GE Multilin™ Advanced Training Services, we offer world-class CEU recognized courses in the areas of Power System Protection, Control, Maintenance, Communications, and Monitoring for:

- Protection Engineers
- Maintenance & Electrical Personnel
- HMI & System Integrators
- Power System Consultants

The skills learned through our courses will help maximize your organization's potential by helping meld a skilled workforce with powerful products.

GE Multilin™ Training Centers

At our Training Centers, we offer regularly scheduled published courses with open enrollment. Our advanced Training Centers, located in North America and Europe, contain equipment for hands-on interaction using:

- Relays & meters
- Relay test tools
- Communications equipment
- Personal computers

The key to the success of our training centers is our talented group of instructors. At GE Multilin™, we pride ourselves on having seasoned instructors with years of experience in the protection industry who specialize in teaching technical topics.

At the GE Multilin™ Training Centers, class sizes are kept small so instructors can interact with each student. Students receive comprehensive course manuals with the course notes and detailed lab exercises to ensure they can apply this knowledge in their workplace.

We also take our training on the road throughout the year by presenting our most popular training sessions at different North American centers. Visit www.gemultilin.com/training to keep updated as to when new locations, dates and course topics are added.



On-Site Training Courses

To increase the number of employees who can benefit from our training, we offer the option of conducting training courses at your facility. These on-site courses can be customized to the specific range of topics you want covered. We provide all the necessary equipment and literature needed to duplicate the environment we offer at our Training Centers.



Relays and Meters

Value Added Services

Advanced Training Services

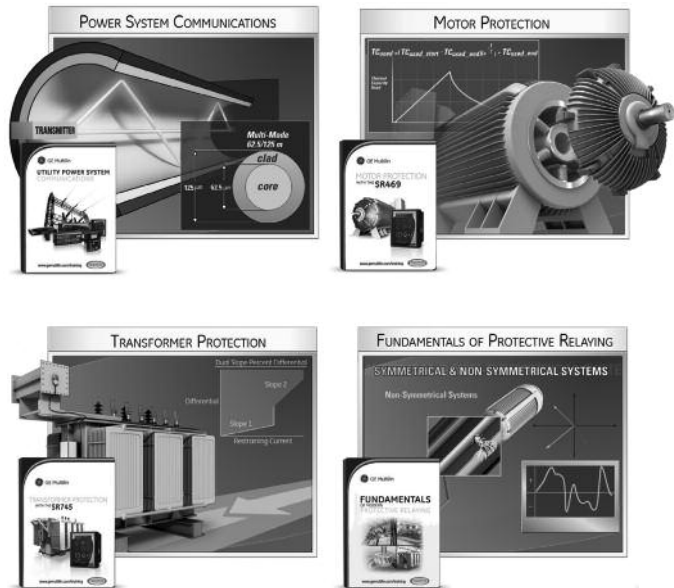
Section 22

Interactive Learning CDs

GE Multilin™ offers the largest selection of computer-based training in the industry. Our interactive learning CDs cover concepts from the basics of protection theory, to configuring advanced relays. These interactive multimedia presentations make complex concepts easy to understand. Students are able to learn at their own pace and review the course material as often as desired.

CEU Credits Now Offered

The Advanced Training Center at GE Multilin™ is authorized by the International Association for Continuing Education and Training (IACET) to award Continuing Education Units (CEU) to participants who successfully complete our training courses. These CEU credits allow Engineers and Technicians to maintain their professional accreditation. Please refer to the course agenda for the number of credits awarded.



Our Most Popular Courses and Learning CDs

Theoretical Courses	Catalog Number
Fundamentals of Modern Protective Relaying	TRNG-FMPR
Power System Protection for Industrial Facilities	TRNG-PIND
Power System Protection for Utilities	TRNG-UIIND
Industrial Power System Communications	TRNG-ICOM
Introduction to the IEC61850 Protocol	TRNG-61850

Product Application Courses	Catalog Number
Distribution Protection Principles and Relaying (SR745, SR750, SR760)	TRNG-DIST
Motor Protection Principles and Relaying (239, 369, SR469, SPM)	TRNG-MOTR
Generator Protection Principles and Relaying (SR489, DGP, G60)	TRNG-GEN
Transmission Line Protection Principles and Relaying (ALPS, D60, L90, L60)	TRNG-LINE
UR Platform	TRNG-URPL

Interactive Learning CDs	Catalog Number
Fundamentals of Modern Protective Relaying	TRCD-FMPR-C-S-1
Utility Power System Communications	TRCD-UCOM-C-S-1
IEC61850	TRCD-61850-C-S-1
Motor Protection with SR469	TRCD-M469-C-S-1
Distance Protection with the D60 Relay	TRCD-D60-C-S-1
Transformer Protection with the SR745	TRCD-SR745-C-S-1
Generator Protection with the SR489	TRCD-SR489-C-S-1

Check with www.GEMultilin.com/training for our complete list of training courses and CDs.



Consulting Services

GE Multilin™ offers a wide range of services to assist you with solutions to your Power Protection challenges. Our team of experienced Consulting Services Engineers can help you with end-to-end solutions or specific activities including designing, commissioning and maintaining protective relaying systems and power system protection devices.

Design of Protection & Automation Solutions

From new power systems to the upgrade of existing systems, trust the experience of GE Multilin™ to evaluate, design and deliver.

Performing Protection System Studies

- Arc Flash Studies
- Load Flow & Fault Studies
- System & Relay Coordination Studies
- System Transient Studies using EMTP and RTDS

Reviewing Relay Logic & Settings Files

- Recommending changes to meet IEEE, NERC Standards
- Improving IED Utilization

Designing Customized Protection & Automation Systems

- Creating Relay Settings Files
- Developing Engineering Drawings
- Equipment Selection
- End-to-End Solutions

Designing Wide Area Protection Schemes

- High-speed Digital Teleprotection
- Transmission/Distribution Remedial Action Schemes (RAS)
- System-Wide Peer-to-Peer Communications using IEC61850 GSSE/GOOSE

Creating Automatic Transfer Schemes

- Developing Custom Logic and Settings Files
- In-house Verification Testing



Power System Modeling and Protection Performance Testing

At our in-house RTDS Lab, GE Multilin™ engineers create highly accurate computer models of your power system and its components (based on EMTP) in order to perform real-time closed loop testing. System behavior can be simulated and analyzed under a variety of fault conditions.

Literally thousands of fault scenarios can be run on your system model using automated test scripts. Our engineers analyze the results and manually step you through any abnormal or unexpected system operations. We then assist with recommendations on alternate protection schemes, equipment selection, and optimizing relay settings and control logic. RTDS test results and our recommendations for system improvement, are provided in a detailed report along with the relay event records and oscillography files.

GE Multilin™ can help you understand how your power system and its protection and control devices will respond to failure situations. Gain the assurance and peace of mind of knowing that your protection and control functions will operate as required when you need them most.

Real Time Digital Simulator (RTDS) Testing

- Time-domain (transient) modeling of large power systems
- Playback of large COMTRADE files for protection testing
- Flexible AC Transmission Systems (FACTS), wind generator modeling

Protection Scheme Performance Verification

- Validate protective relaying schemes against customer power system
- Parallel performance testing of different protection philosophies
- Testing of GE and non-GE protection IEDs
- Scheme testing using IEC61850 GOOSE/GSSE
- Complete test reports and documentation including event sequence and oscillography

On-Site Field Services

Have the experts who design and build your relays help you evaluate, test and commission your protection and control system. Our team of knowledgeable field engineers can test and verify that your protection devices are connected properly and will operate as designed.

Site/System Surveys

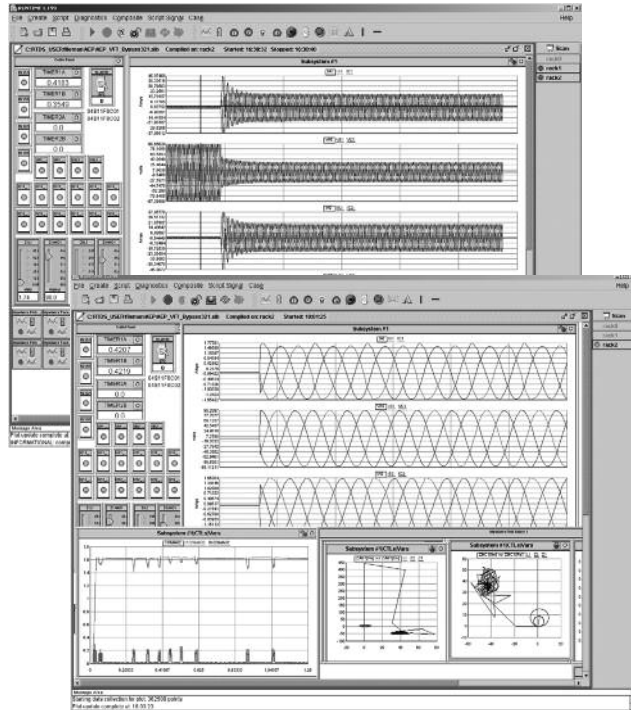
- Document Existing Protection and Control Systems
- Recommendations Report

Protection System Commissioning

- Relay & Panel Testing
- Wiring Verification

Protection System Field Troubleshooting

- Fault Data Collection & Analysis
- Recommendations & Solutions
- Upgrading Relay Firmware
- Uploading Relay Settings Files



Relays and Meters Value Added Services Packaged Solutions

Section 22

Global One Stop Solutions

GE Multilin™ Packaged Solutions is a comprehensive offering that brings tremendous value to our customers in meeting their power system protection, control, metering and communication needs. By providing a complete solution where all of the parts are engineered to work together, Packaged Solutions save time and money while increasing performance and reliability. Join the growing number of satisfied Utility and Industrial customers who trust GE Multilin™'s expertise to handle the following project requirements:

- Project Management
- Material Procurement & Sourcing
- Panel Design & Construction
- Relay setting upload
- Panel testing & protection verification
- Commissioning

Choose from a number of available pre-engineered Packaged Solutions, or work with GE Multilin™ Consulting Services to provide a custom package to best fit the application. Indoor or outdoor, free standing or pole-mounted, our repeatable and ready-to-install solutions use highly reliable GE Multilin™ products for a wide variety of applications.

- Generators and Distributed Generation (DG)
- Transformers & Reactors
- Transmission and Sub-transmission Lines
- Capacitor Banks
- Distribution Feeders
- Reclosers & Pole-top RTUs
- Motors and Pumps
- Power Quality and Revenue Metering
- Remedial Action Schemes (RAS)
- Wide-Area Special Protection Systems (SPS)

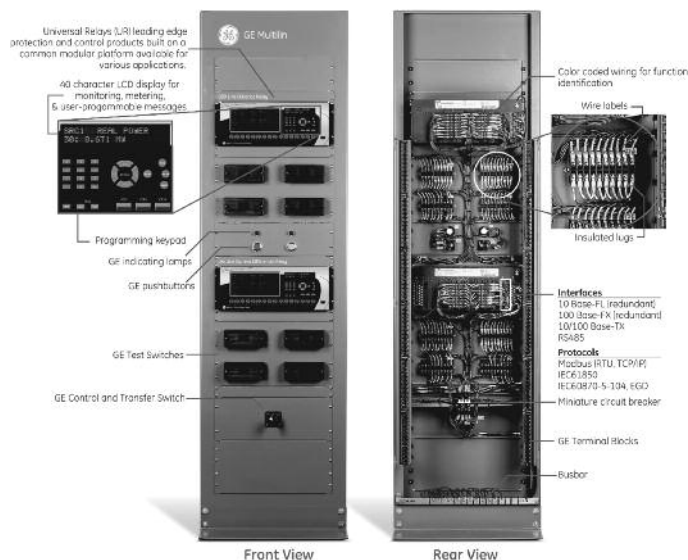
GE Multilin™ Packaged Solutions has the flexibility to create the look, feel, and functionality required to suit our global customer's. Panels are provided with powder coated painted finish available in any single color to match specific project specifications.

All wiring used in our solutions is either flame resistant or selfextinguishing and conforms to international standards and individual customer requirements. Wiring is run in the ducting to keep the layout organized, and color-coded by function for easy identification (example: Green for Ground, Blue for DC Power, Red for CT's, Black for VTs).

Labelling is also fully customizable from our standard white on black, with laminated panel labels fitted on the front, back, and inside of cubicles. Terminal block markings and test switch labels are provided to customer specifications. Customized LED labels on the relays can also be created to match the programmed functionality of the devices.



Freestanding Rack



Relays and Meters Protection & Control Product Upgrades and Replacements

Section 22

[SR Relays Basic to Enhanced Upgrade](#)

Upgrade basic SR System to enhanced SR System



[169/269 to 369](#)

Replace 169 Motor Management Relay™ with the 369 Motor Protection System



[139 to 239](#)

Replace 139 Motor Management Relay™ with the 239 Motor Protection System



[P4A to 239](#)

Replace P4A Protection Relay with the 239 Motor Protection System



[MTMPlus to PQM II](#)

Replace MTMPlus Meter with the PQM II Power Quality Meter



[IAC, IFC, SLR, ACR, MDP to MIF II](#)

Replace IAC, IFC, SLR, ACR, MDP Protection Relays with the MIF II Feeder Protection System



[DGP Digital Generator Protection Replacement](#)

Replace DGP with the G60, G30, 489 or G650



[ALPS™ Advanced Line Protection System Replacement](#)

Replace ALPS™ with the L90, L60, D60 or D30



[LPS-O™ Generator Backup Protection Replacement](#)

Replace LPS-O™ with the D60 or G60



[LPS-D™ Line Protection System Replacement](#)

Replace LPS-D™ with the L90, L60, D60 or D30

